

AD-A193 230

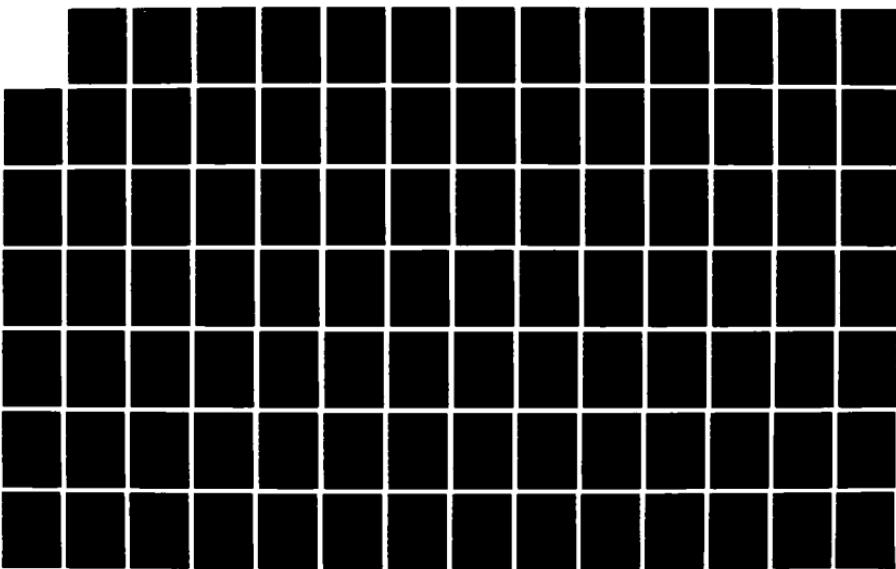
VERTICAL DIRECTIONALITY OF AMBIENT NOISE AT 32 DEG N AS 1/2  
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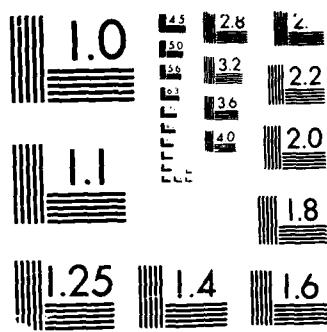
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W S HODGKISS ET AL. JAN 88 MPL-TM-387-C

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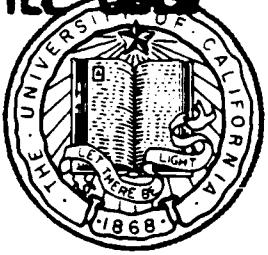




MICROCOPY RESOLUTION TEST CHART

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# MARINE PHYSICAL LABORATORY

SCRIPPS INSTITUTION OF OCEANOGRAPHY

San Diego, California 92152

AD-A193 230

VERTICAL DIRECTIONALITY OF AMBIENT NOISE  
AT 32° N AS A FUNCTION OF LONGITUDE:  
Tape #86060

W. S. Hodgkiss and F. H. Fisher

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APR 15 1988  
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MPL TECHNICAL MEMORANDUM 387-C

MPL-U-32/86

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January 1988

## REPORT DOCUMENTATION PAGE

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**Vertical Directionality of Ambient Noise**

**at 32° N as a Function of Longitude:**

**Tape #86060**

W.S. Hodgkiss and F.H. Fisher

Marine Physical Laboratory  
Scripps Institution of Oceanography  
San Diego, CA 92152

**Abstract**

Measurements have been made of the ambient noise field between 25 and 300 Hz with vertical arrays at 32° N (124° W, 136° W, and 150° W). This technical report contains the complete analysis results for the MPL 27-element vertical array Tape #86060. The tape was recorded at 32° N, 124° W (approximately 350 nmi due west of San Diego) on 27 April 1986 beginning at 06:34 PDT. At that time, the wind speed was 22 kts.

## I. Introduction

This technical report contains the complete analysis results for the MPL 27-element vertical array tape #86060. The tape was recorded at 32°N, 124°W (approximately 350 nmi due west of San Diego) on 27 April 1986 beginning at 06:34 PDT. At that time, the wind speed was 22 kts.

A complete description of the experiment and data analysis procedure is given in the summary technical report (TM-387-A). Here, a brief guide will be provided to the results documented in the the various sections.

Section II (Preliminary Analysis) provides a preliminary look at the data quality from 4 hydrophones spaced approximately equally across the array for the first data segment (65536 points). The results are ordered as follows:

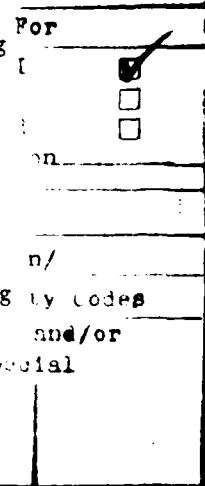
- (1) Channel means (A/D counts).
- (2) Time series (A/D counts) for the first 1024 points of the first segment.
- (3) Time-varying mean (A/D counts, 64-point averages).
- (4) Time-varying power (A/D counts squared, 64-point averages) (channel means have been removed).
- (5) Power spectra (dB// $\mu$ Pa/ $\sqrt{\text{Hz}}$ ) (channel means have been removed).

Section III (Power Spectra) provides an extended preliminary look at the power spectra from all hydrophones in the array for the first data segment (65536 points). The results are ordered as follows;

- (1) Channel means (A/D counts).
- (2) Power spectra (dB// $\mu$ Pa/ $\sqrt{\text{Hz}}$ ) (channel means have been removed).

Section IV (Array Response: Waterfall, KB Window) provides waterfall plots of the time-evolving vertical directionality of ambient noise for successive segments (65536 points) across the entire data tape (dB// $\mu$ Pa/ $\sqrt{\text{Hz}}\text{Deg}$ ). A Kaiser-Bessel window ( $\alpha = 1.5$ ) was used to amplitude shade the array elements.

Section V (Array Response: Waterfall, Rect Window) provides waterfall plots of the time-evolving  $\mathbf{R}_k$  codes.



vertical directionality of ambient noise for successive segments (65536 points) across the entire data tape (dB// $\mu$ Pa/ $\sqrt{\text{Hz}}\text{Deg}$ ). A rectangular window was used to amplitude shade the array elements.

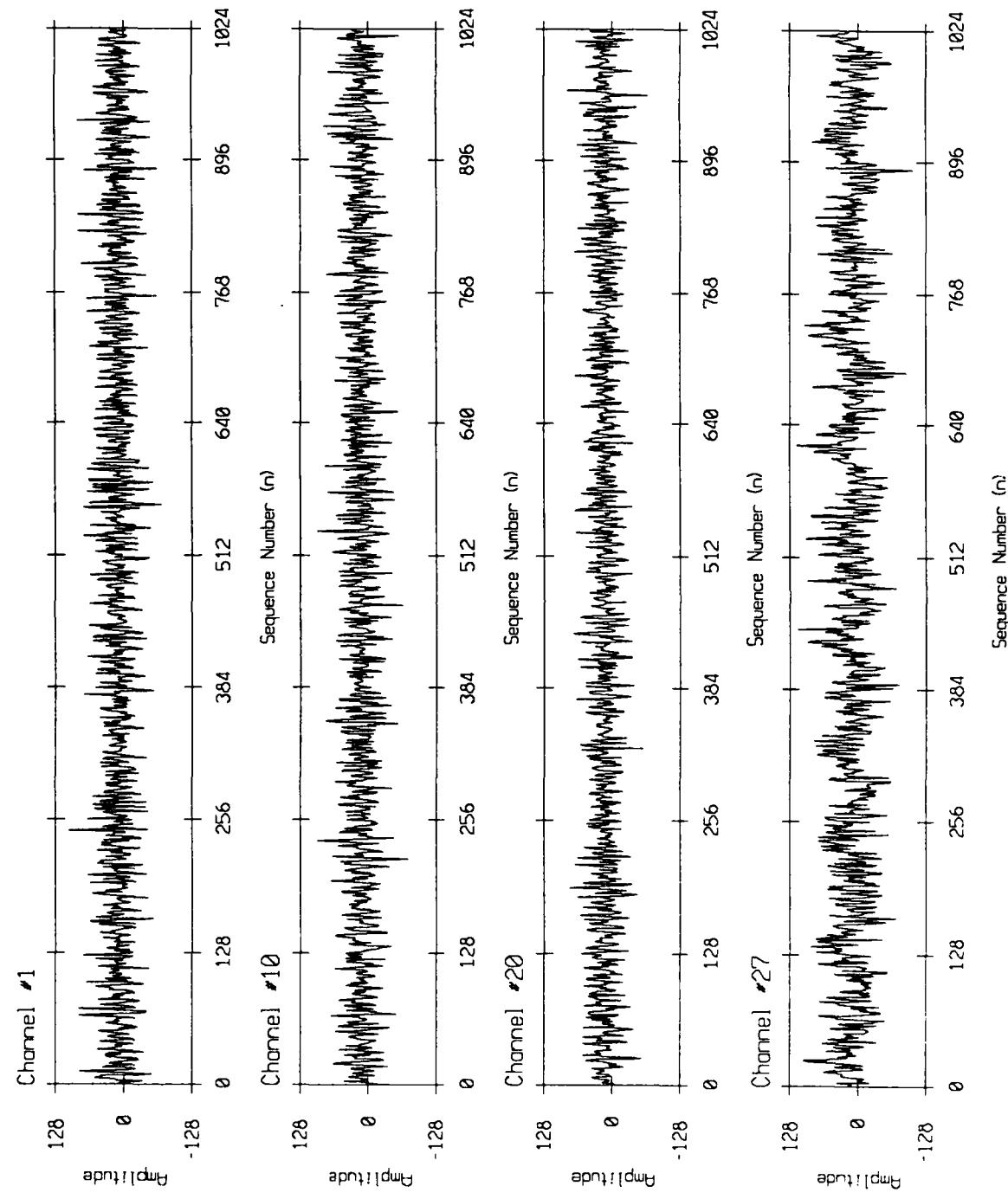
Section VI (Array Response: Panels, KB Window) provides multi-panel plots of the time-evolving vertical directionality of ambient noise for successive segments (65536 points) across the entire data tape (dB// $\mu$ Pa/ $\sqrt{\text{Hz}}\text{Deg}$ ). A Kaiser-Bessel window ( $\alpha = 1.5$ ) was used to amplitude shade the array elements.

Section VII (Array Response: Panels, Rect Window) provides multi-panel plots of the time-evolving vertical directionality of ambient noise for successive segments (65536 points) across the entire data tape (dB// $\mu$ Pa/ $\sqrt{\text{Hz}}\text{Deg}$ ). A rectangular window was used to amplitude shade the array elements.

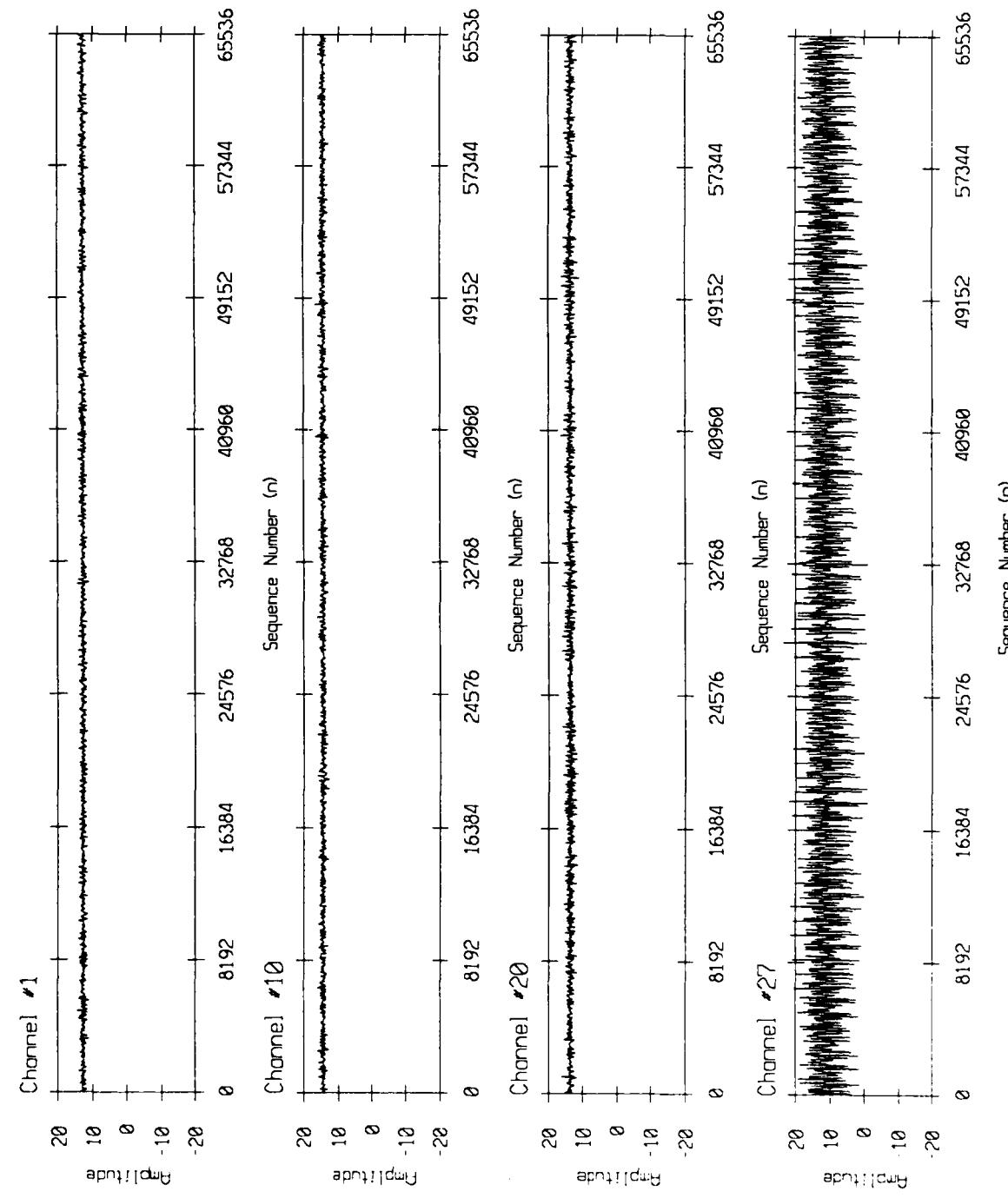
**II. Preliminary Analysis.**

Channel #1  
1 12.944747924805  
Channel #10  
1 14.547775268555  
Channel #20  
1 13.813934326172  
Channel #27  
1 11.458801269531

Time Series - 86060.1

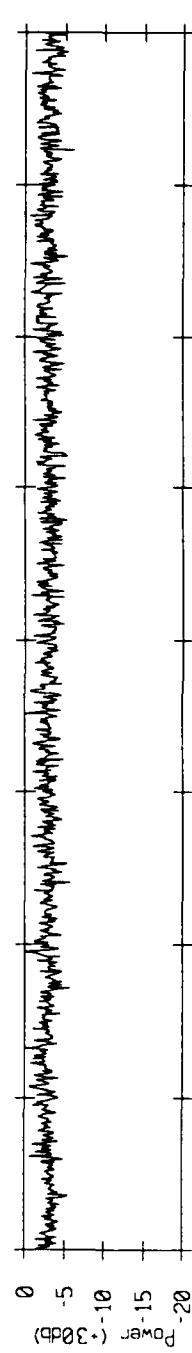


Time Series Mean - 86060.1

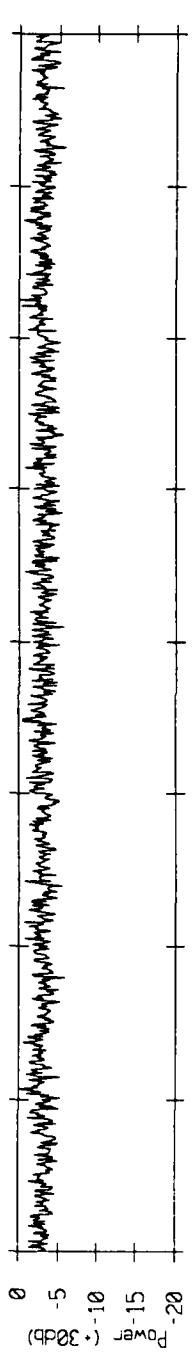


Time Series Power - 86060.1

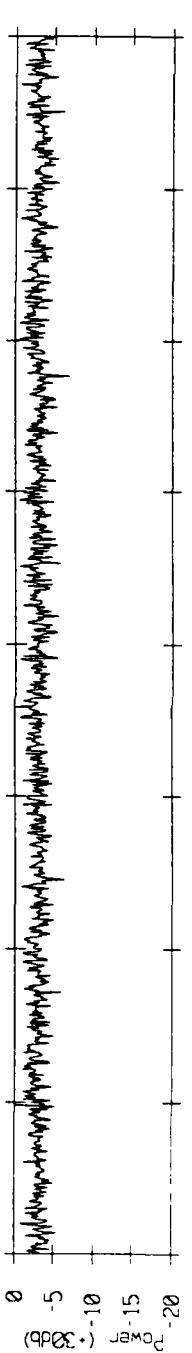
Channel #1



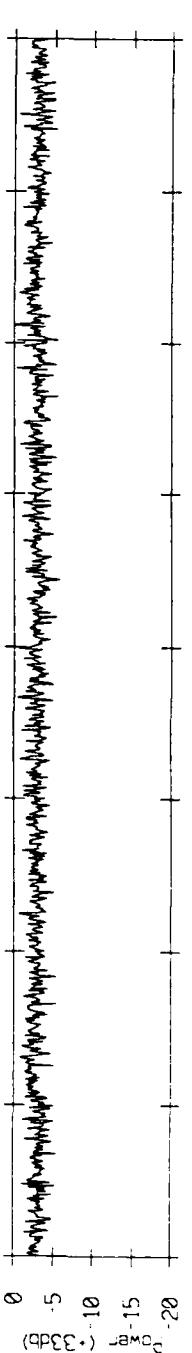
Channel #10



Channel #20

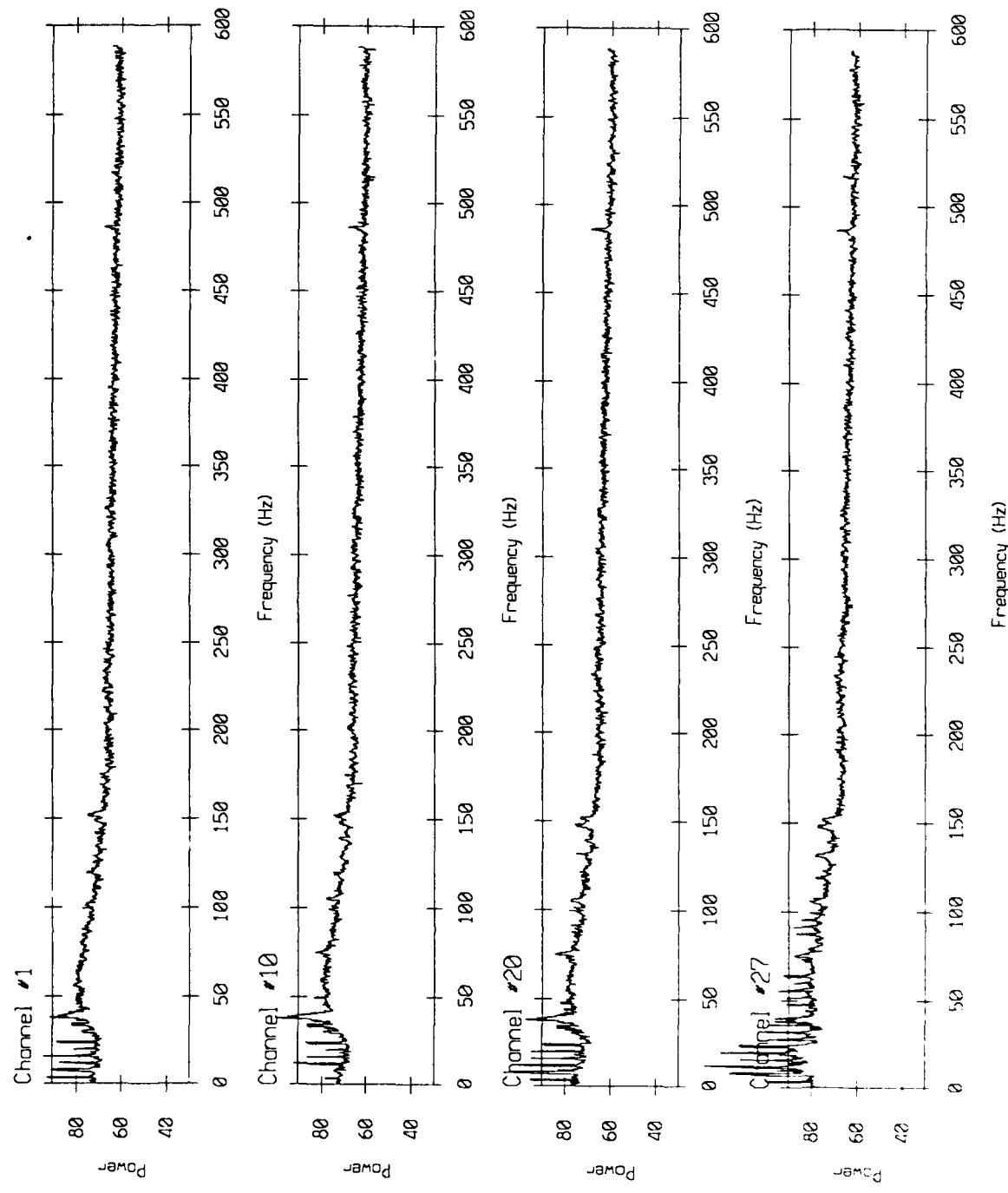


Channel #27



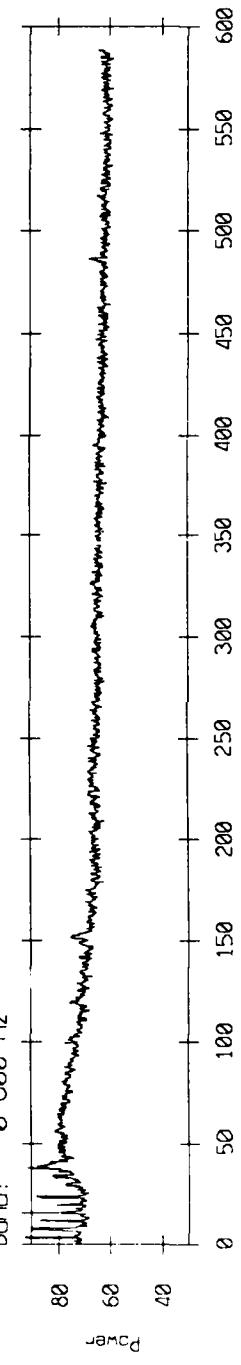
Sequence Number (n)

Power Spectrum - 86060.1



Power Spectrum - 86060.1 Channel #1

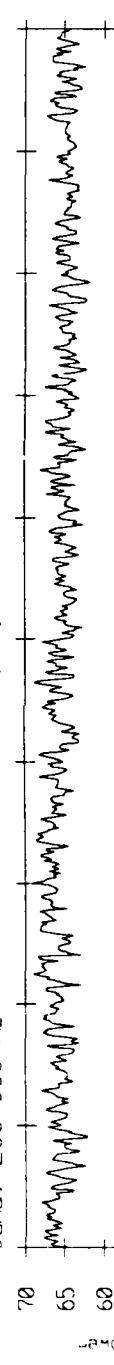
Band: 0-600 Hz



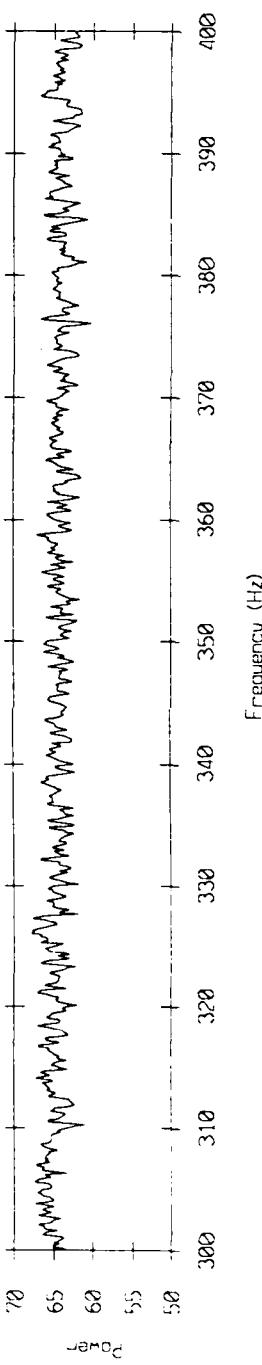
Band: 100-200 Hz



Band: 200-300 Hz

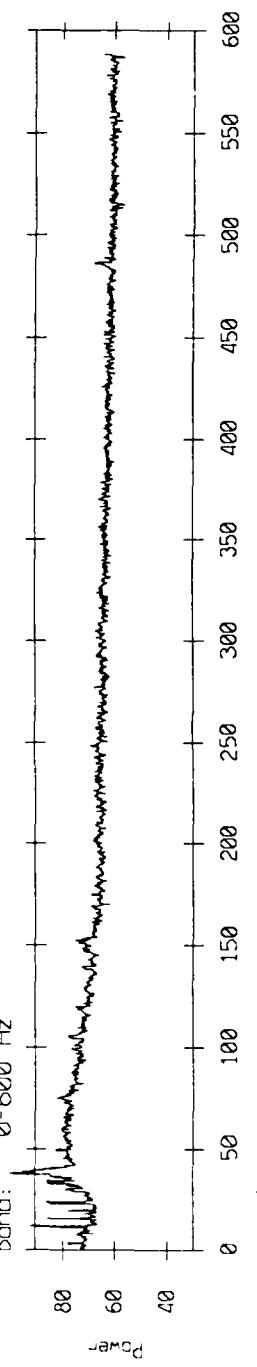


Band: 300-400 Hz



Power Spectrum - 86060.1 Channel #10

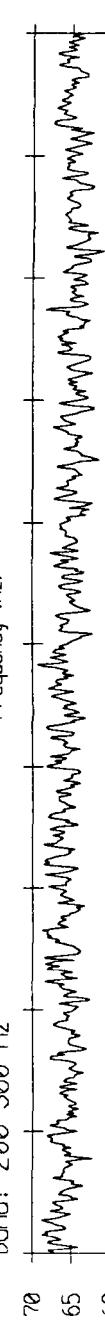
Band: 0-600 Hz



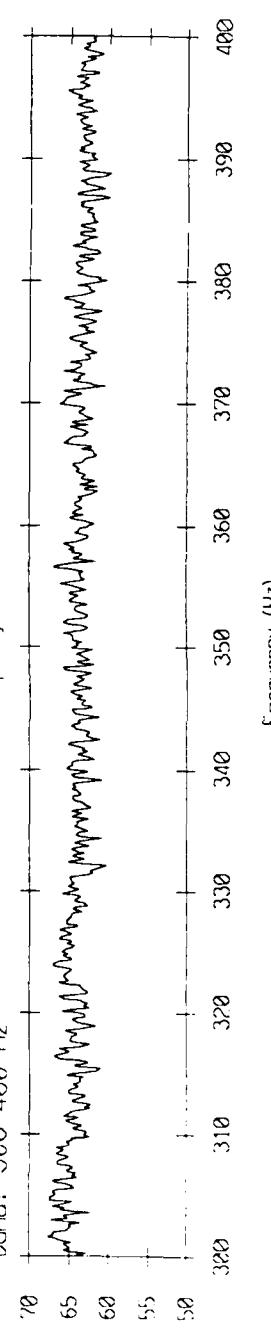
Band: 100-200 Hz



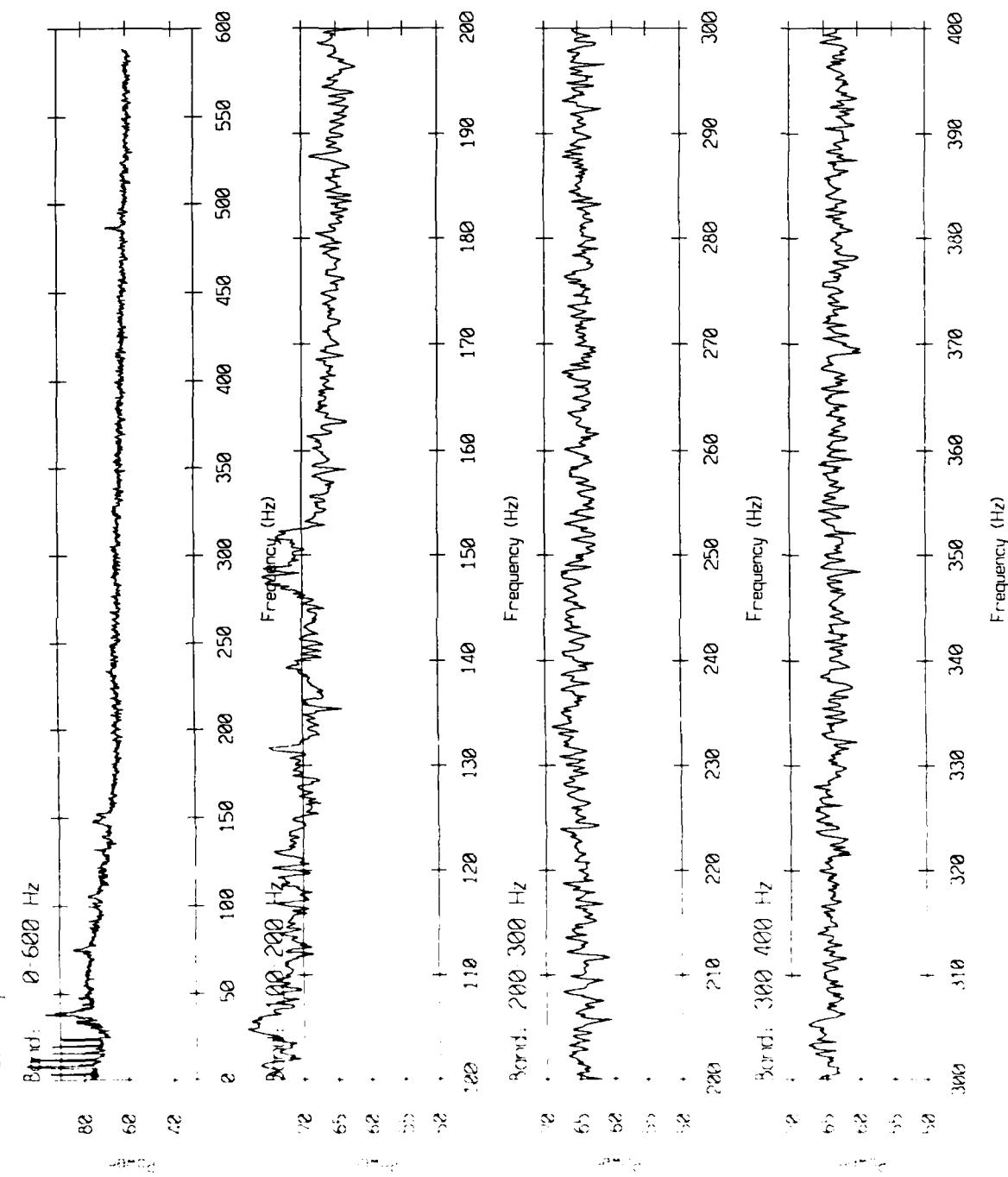
Band: 200-300 Hz



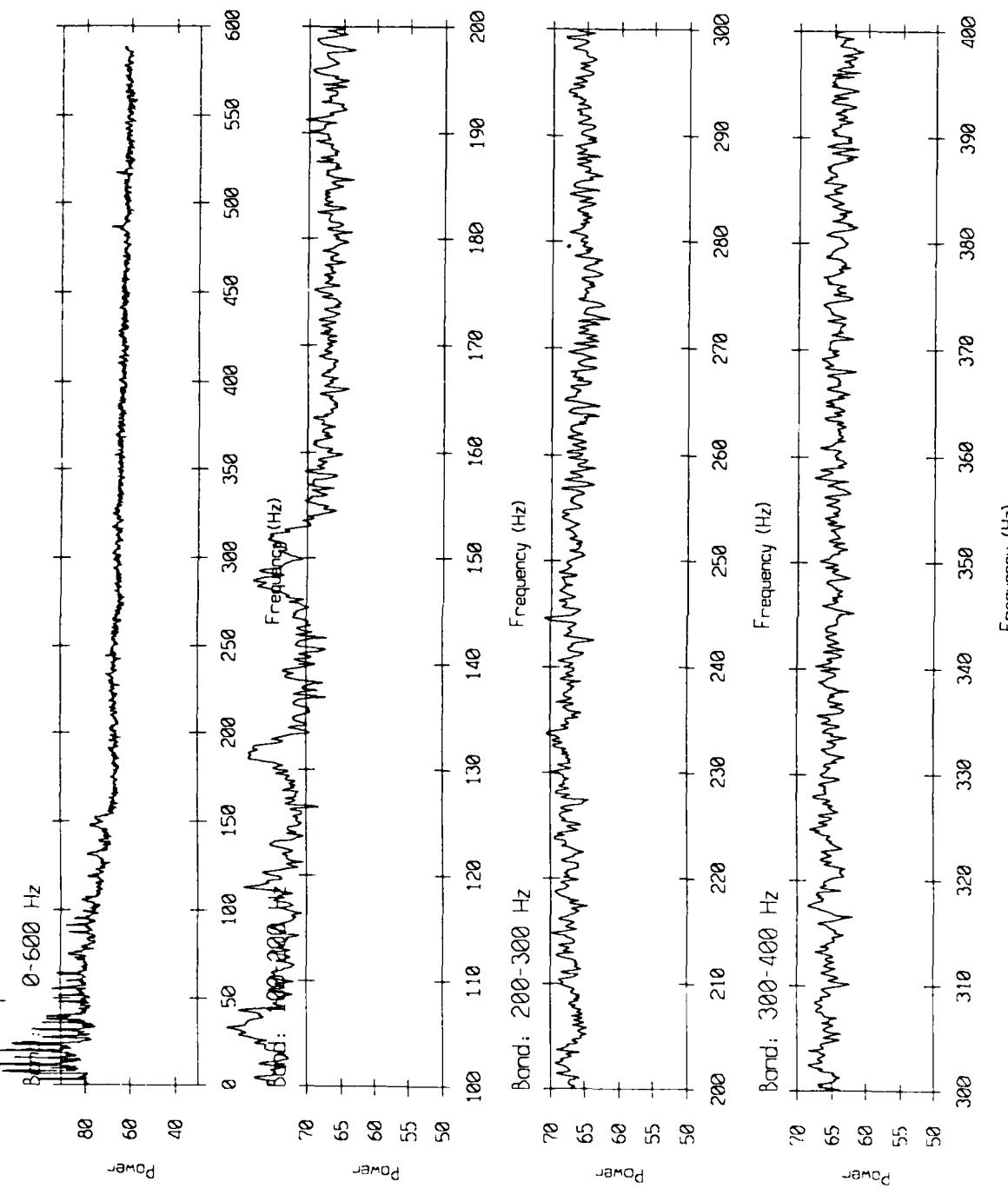
Band: 300-400 Hz



Power Spectrum - 86060.1 Channel 20



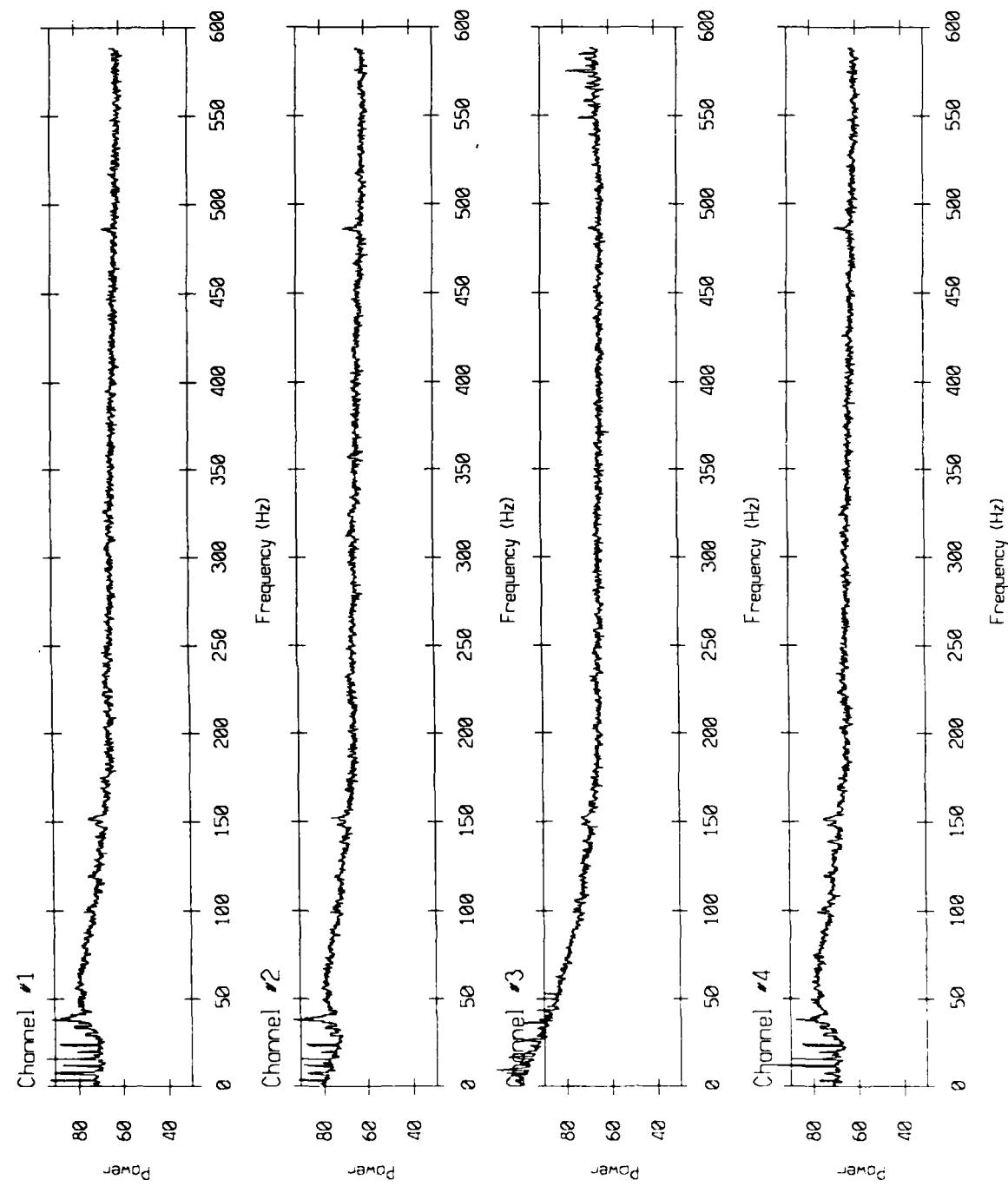
Power Spectrum - 860060.1 Channel #27



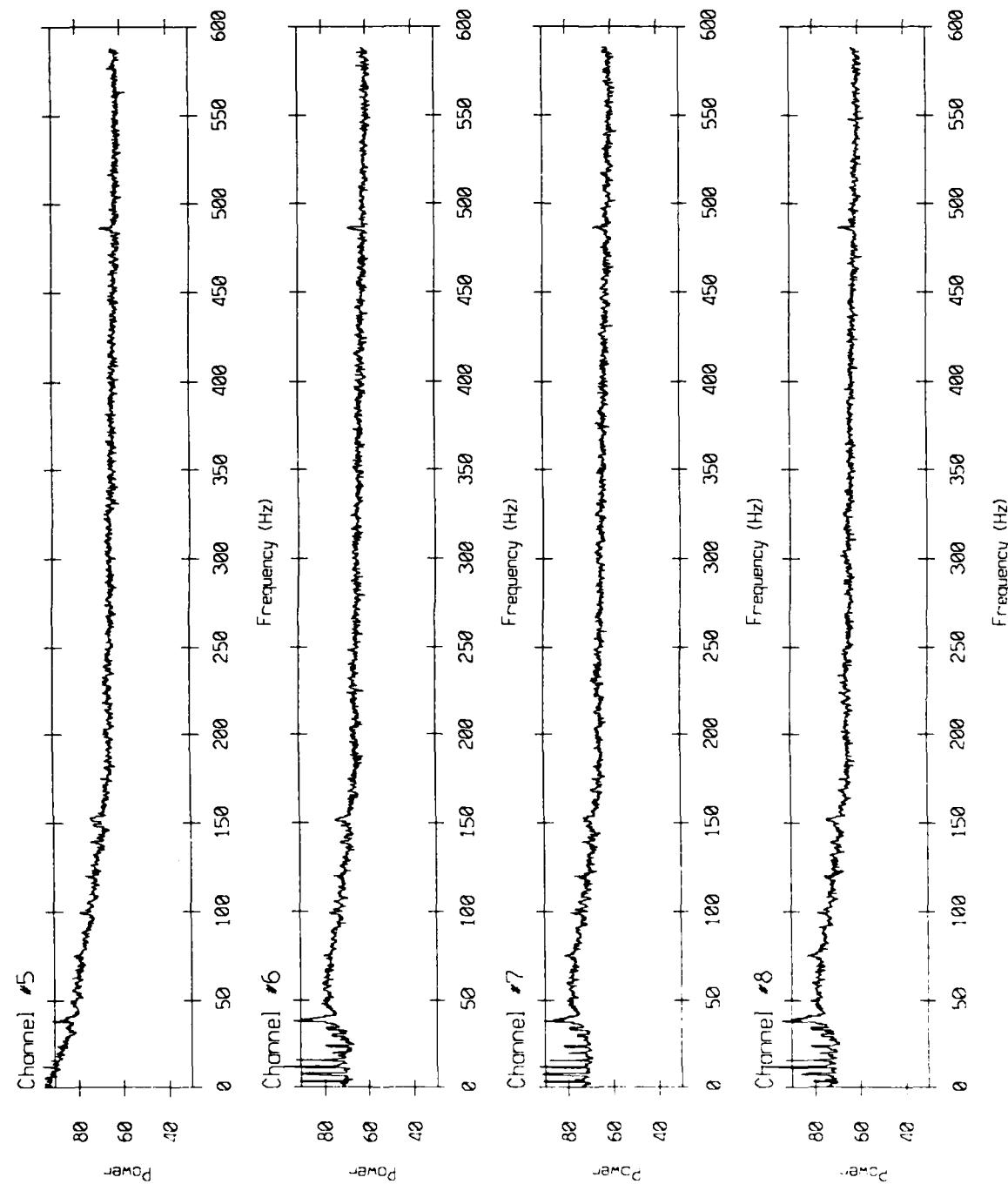
III. Power Spectra.

Channel #1  
1 12. 944747924805  
Channel #2  
1 11. 466491699219  
Channel #3  
1 11. 199615478516  
Channel #4  
1 10. 926193237305  
Channel #5  
1 12. 488723754883  
Channel #6  
1 9. 8551940917969  
Channel #7  
1 14. 709869384766  
Channel #8  
1 14. 914657592773  
Channel #9  
1 6. 4771270751953  
Channel #10  
1 14. 547775268555  
Channel #11  
1 10. 473587036133  
Channel #12  
1 14. 125381469727  
Channel #13  
1 10. 947708129883  
Channel #14  
1 -62. 291854858398  
Channel #15  
1 12. 481811523438  
Channel #16  
1 8. 7545318603516  
Channel #17  
1 13. 131912231445  
Channel #18  
1 12. 899734497070  
Channel #19  
1 -51. 949523925781  
Channel #20  
1 13. 813934326172  
Channel #21  
1 13. 517852783203  
Channel #22  
1 17. 928176879883  
Channel #23  
1 -2. 2237091064453  
Channel #24  
1 11. 433776855469  
Channel #25  
1 13. 617889404297  
Channel #26  
1 14. 033386230469  
Channel #27  
1 11. 458801269531

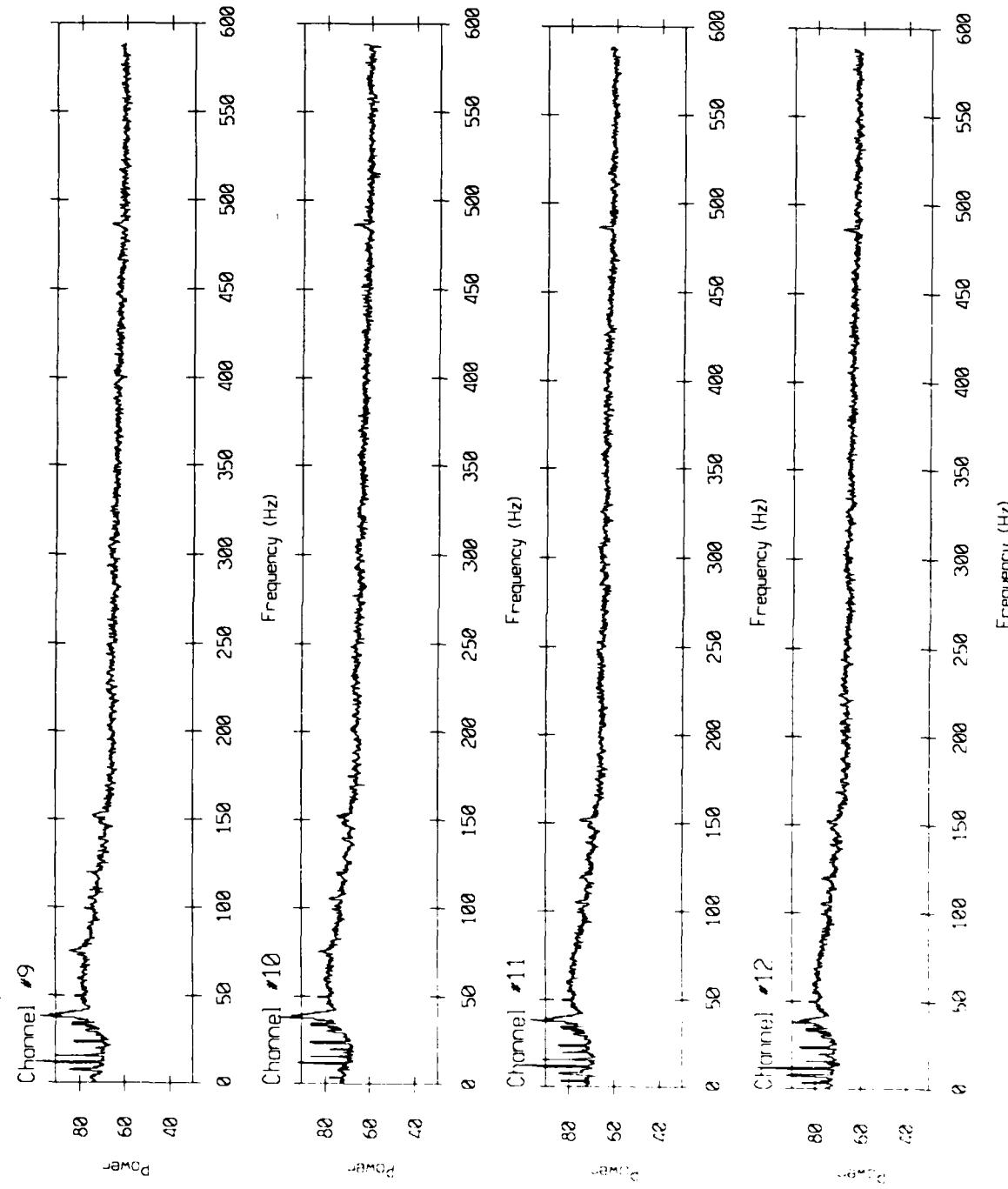
Power Spectrum - 86060.1



Power Spectrum - 86060.1

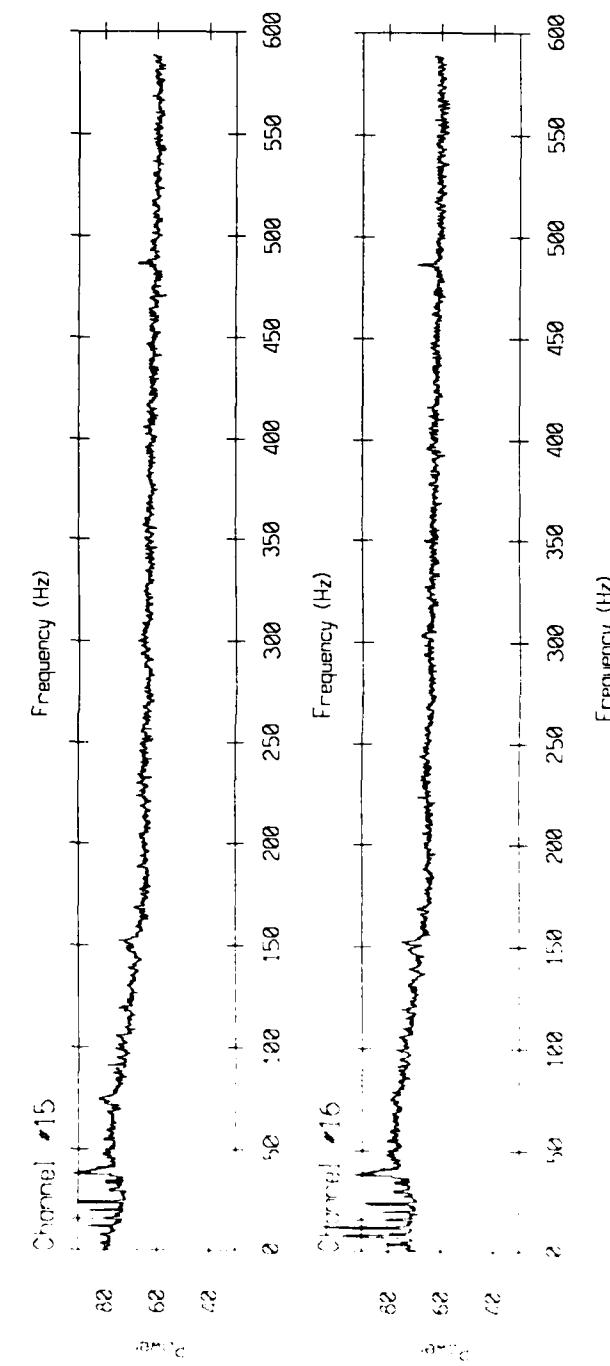
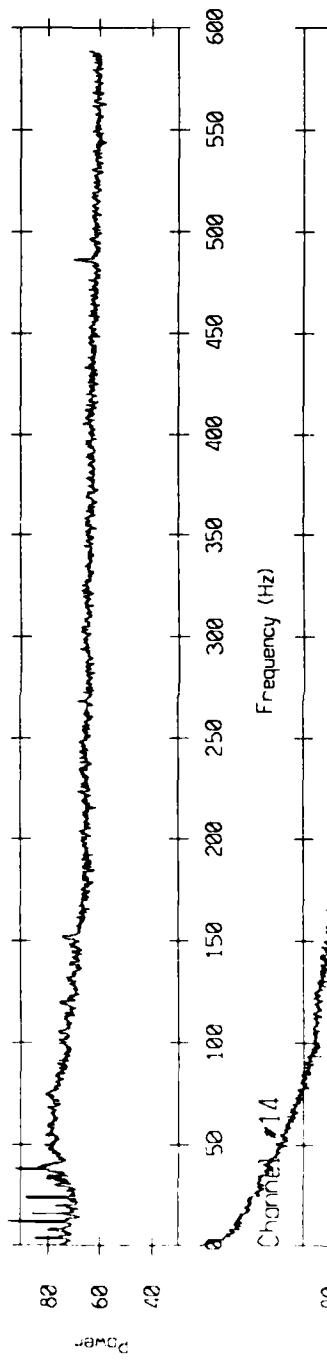


Power Spectrum - 860600.1

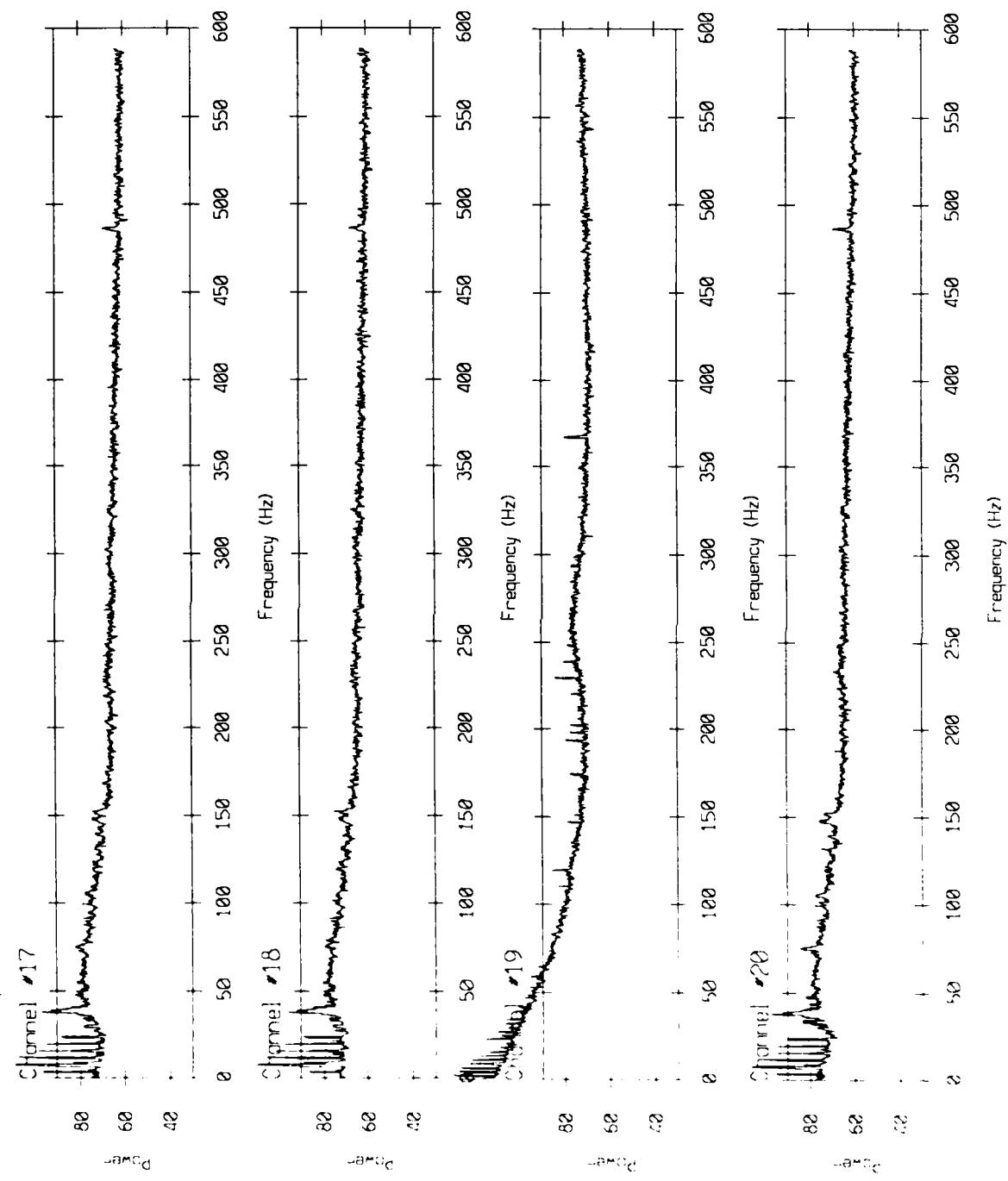


Power Spectrum - 86060.1

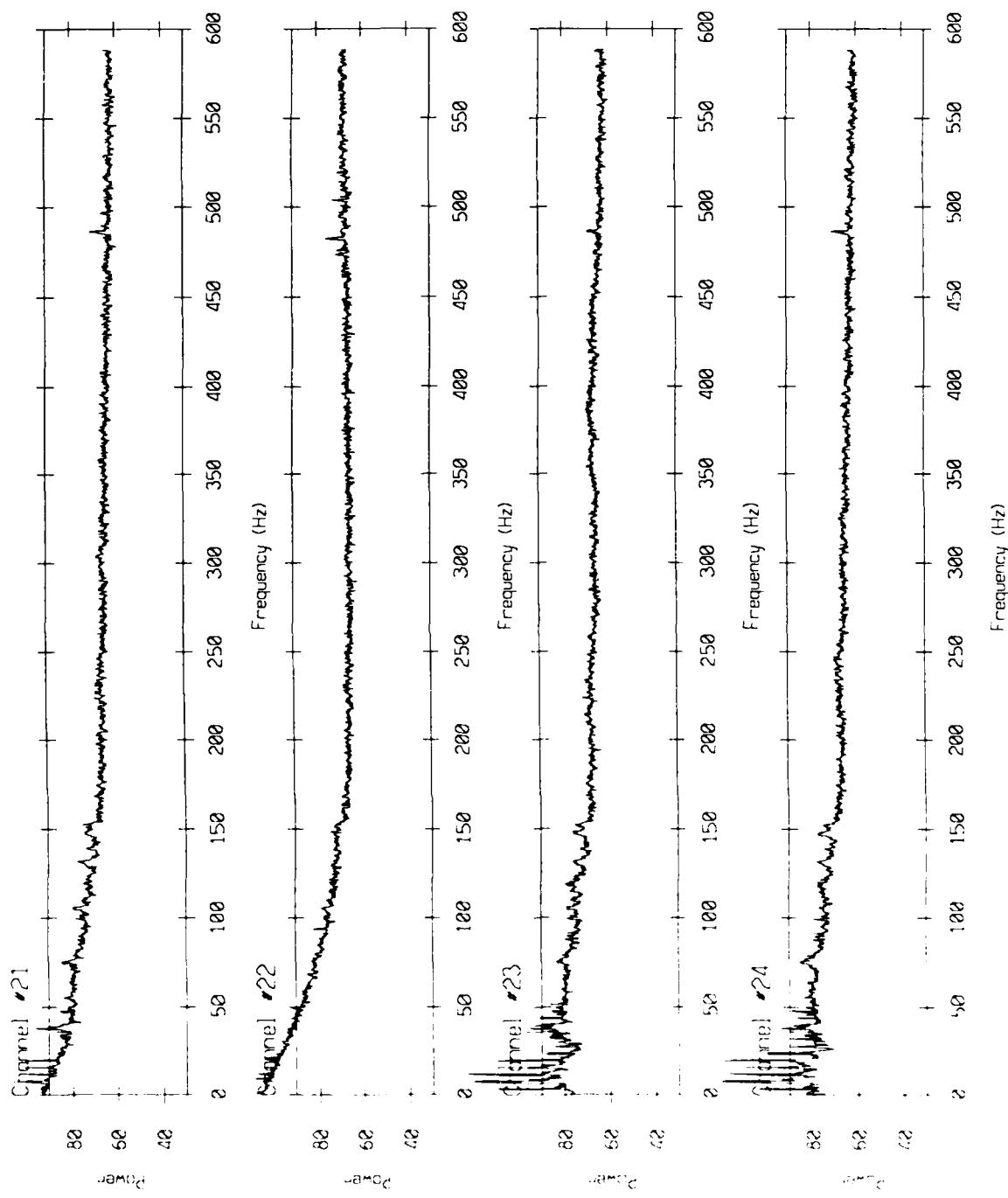
Channel #13



Power Spectrum - 86060.1

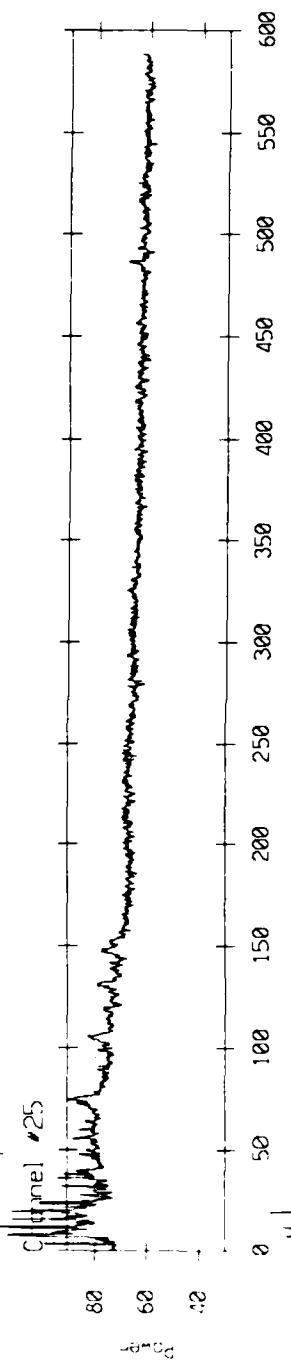


Power Spectrum - 86060.1

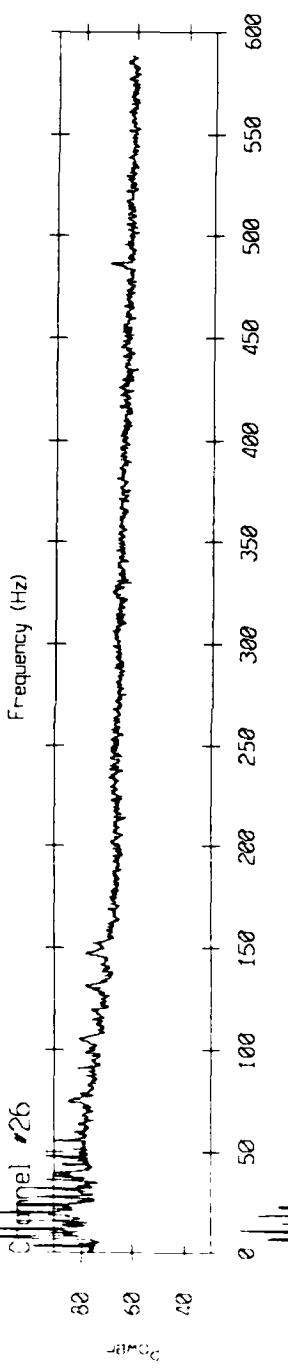


Power Spectrum - 860060.1

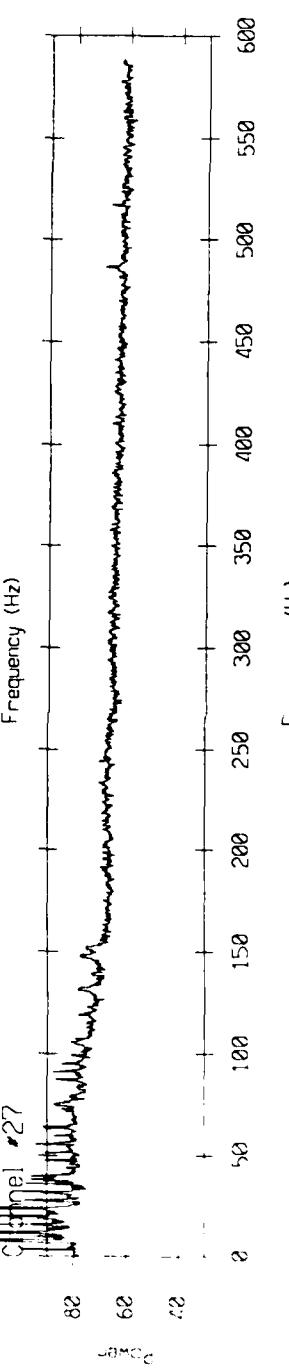
Channel #25



Channel #26

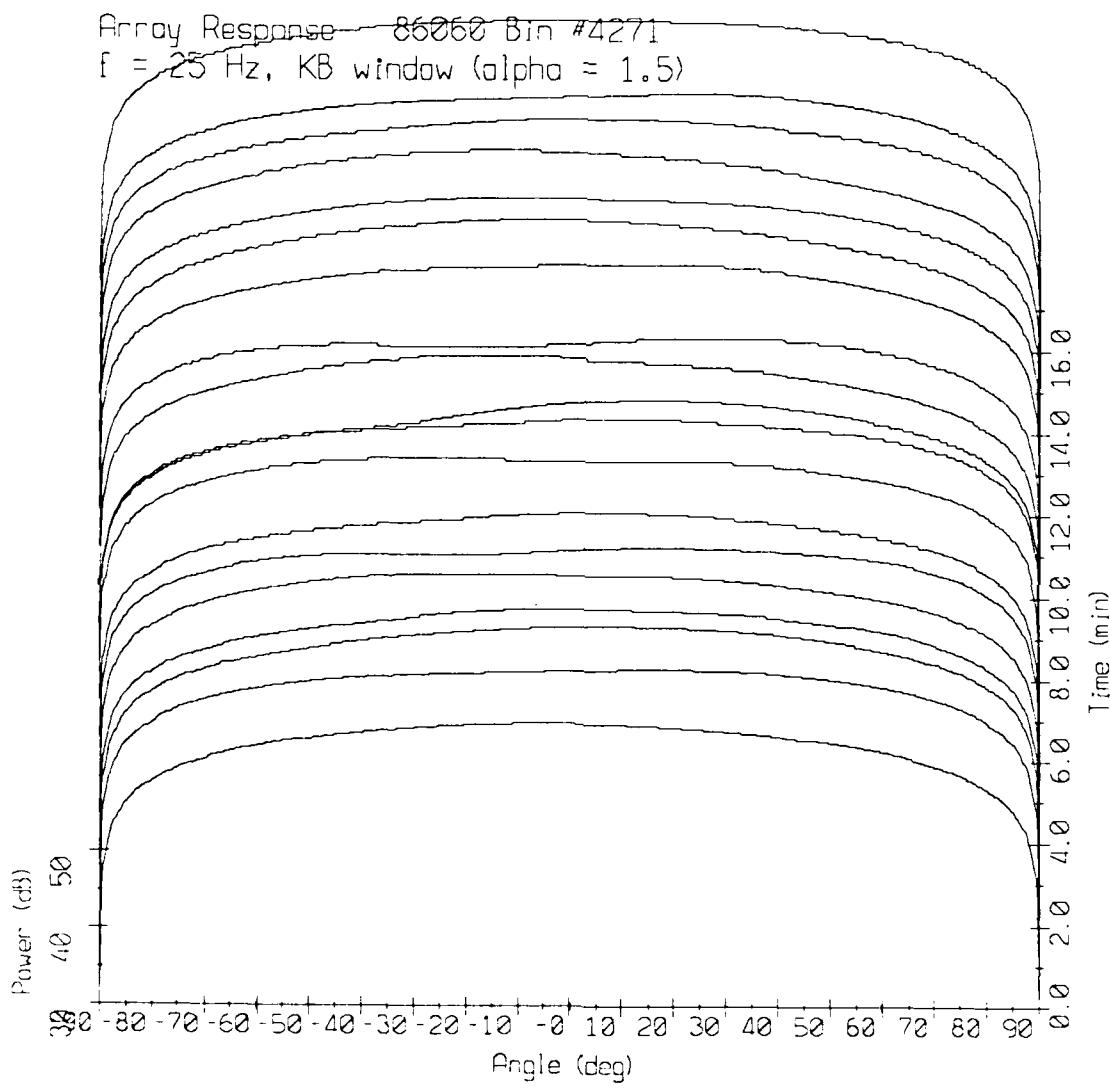


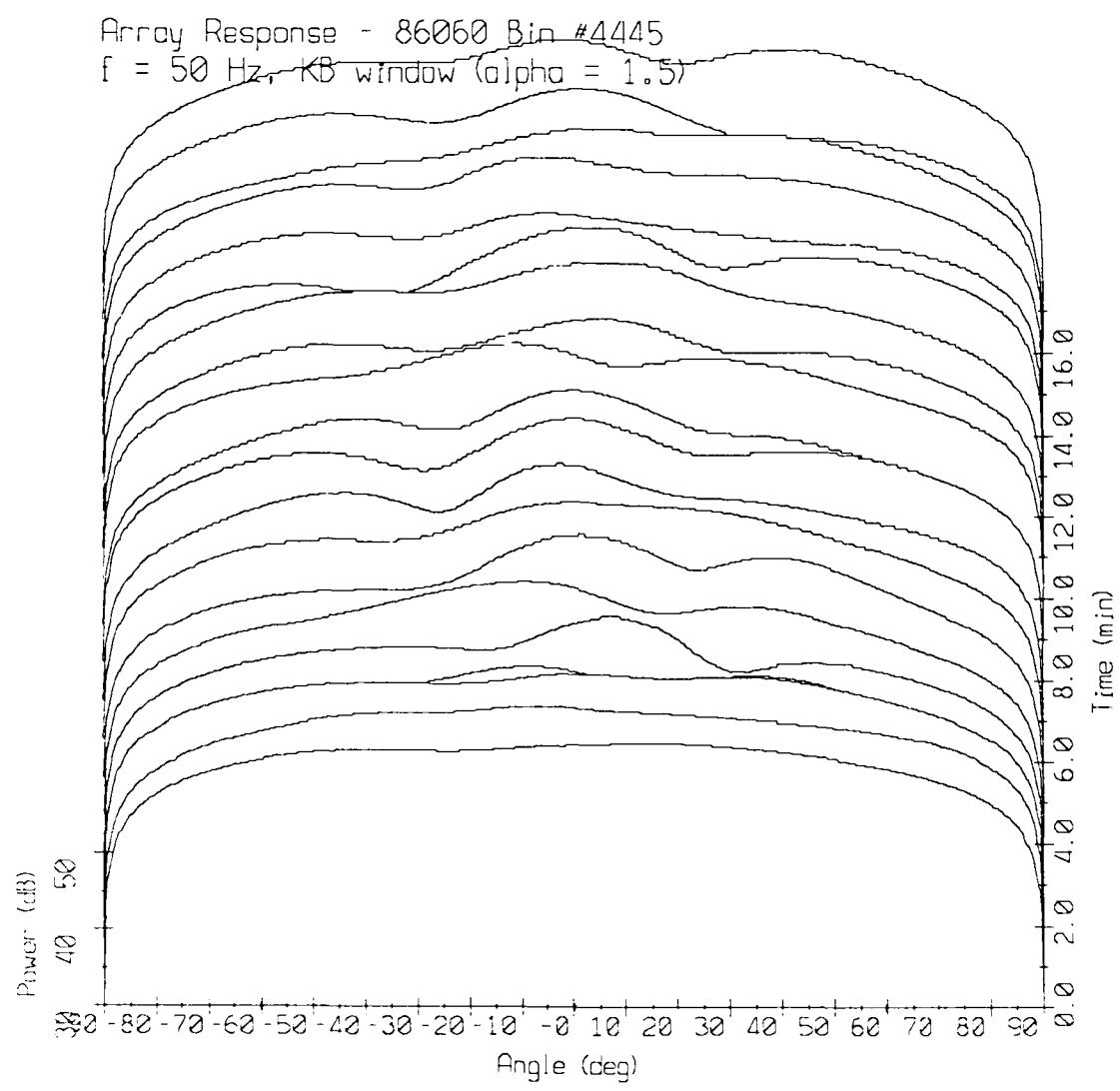
Channel #27



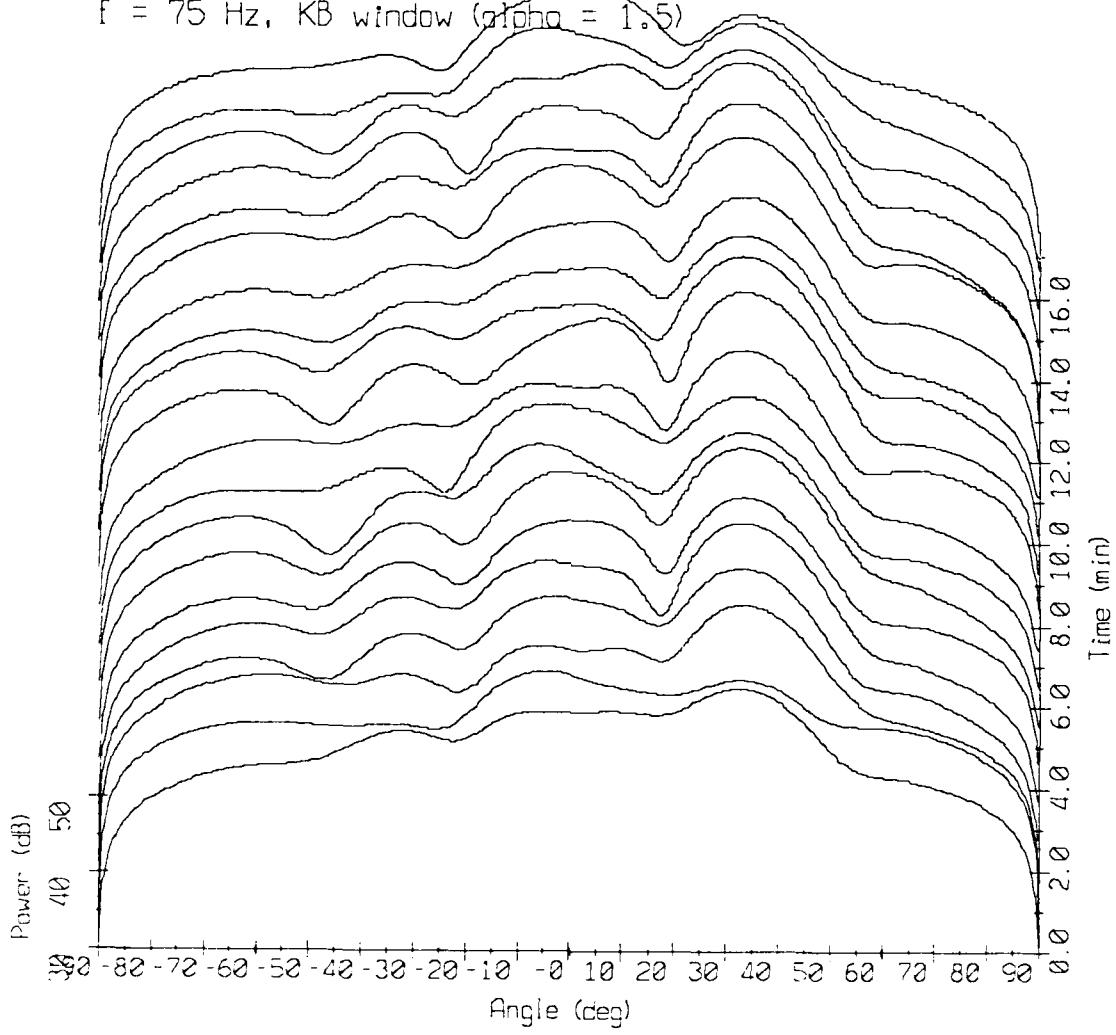
Frequency (Hz)

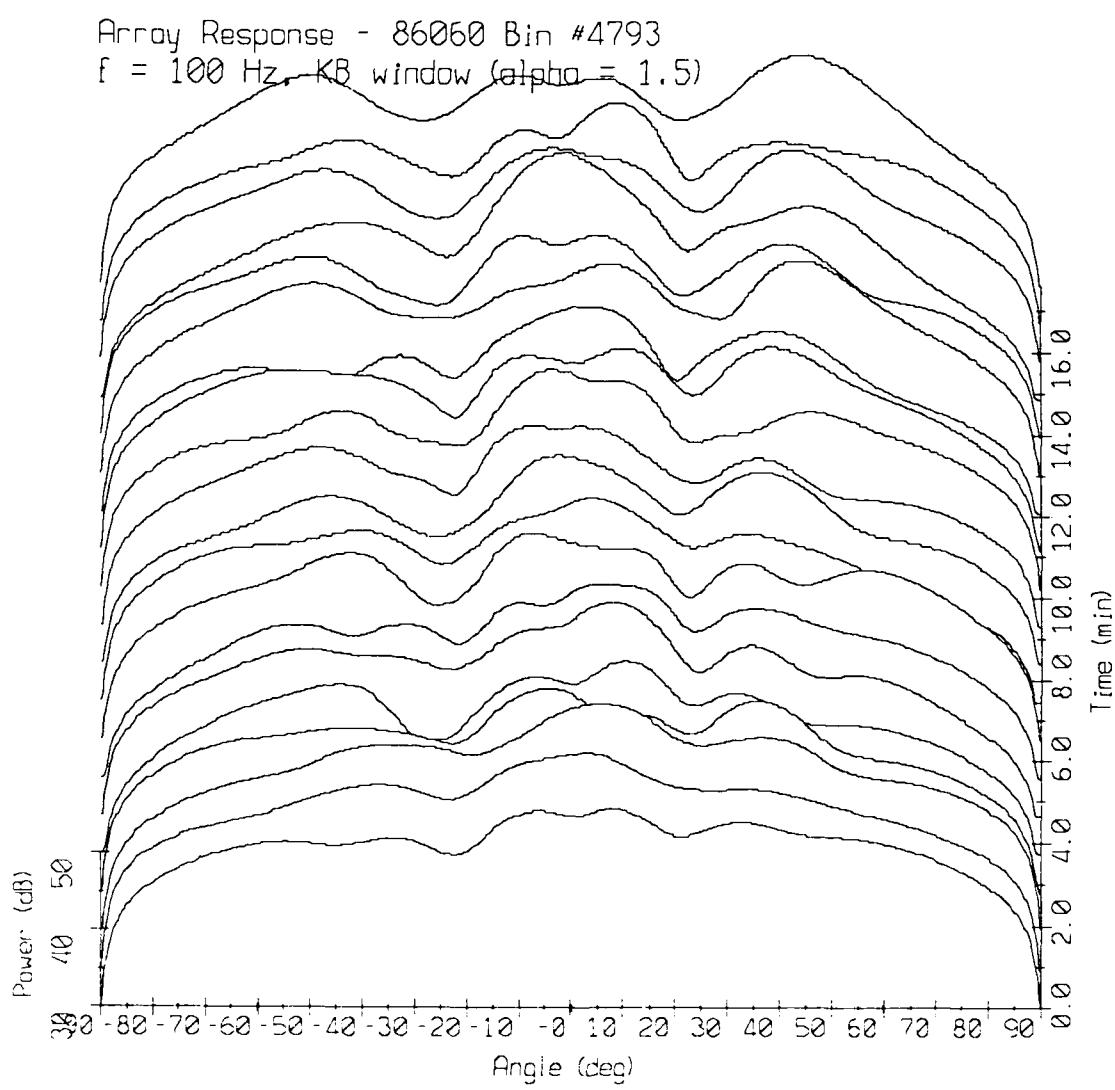
**IV. Array Response: Waterfall, KB Window.**



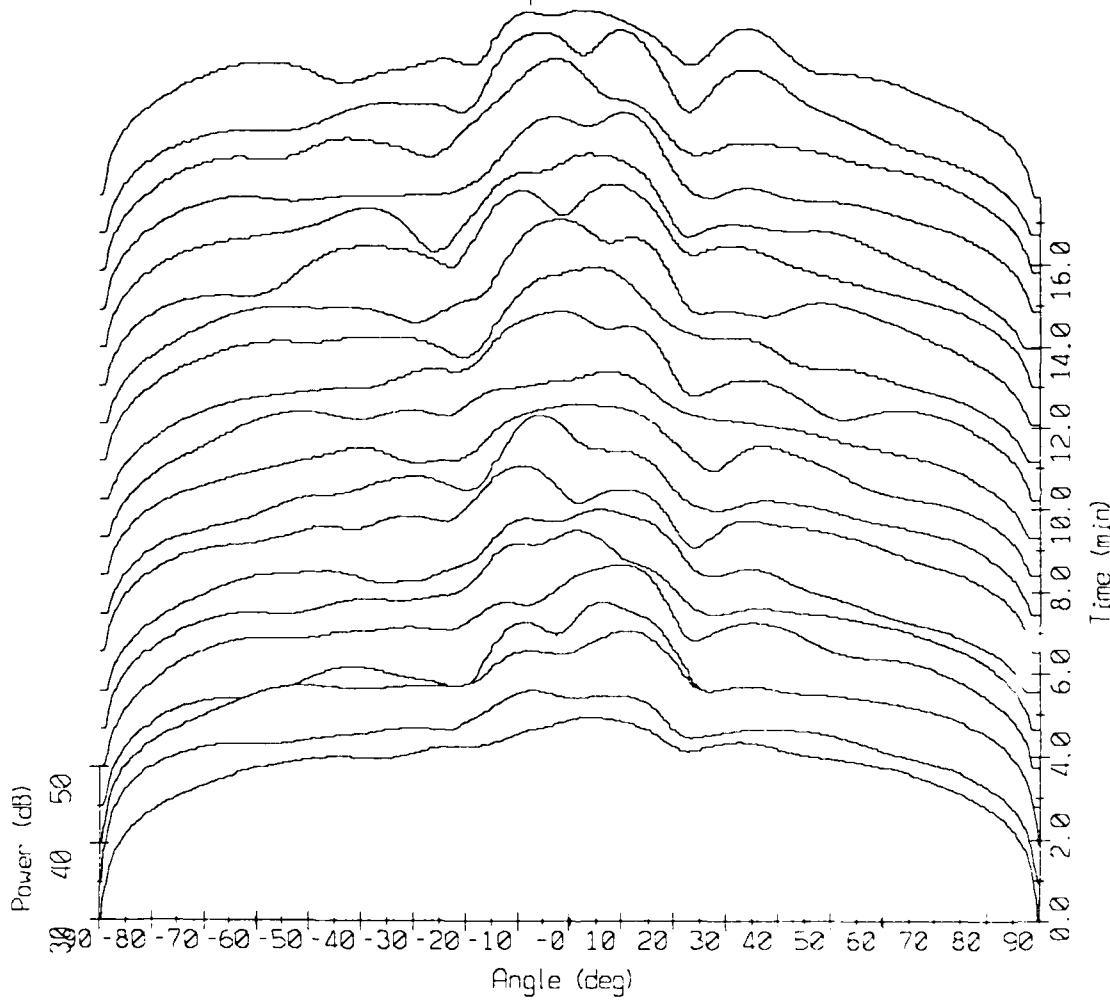


Array Response - 86060 Bin #4619  
 $f = 75$  Hz, KB window ( $\alpha = 1.5$ )

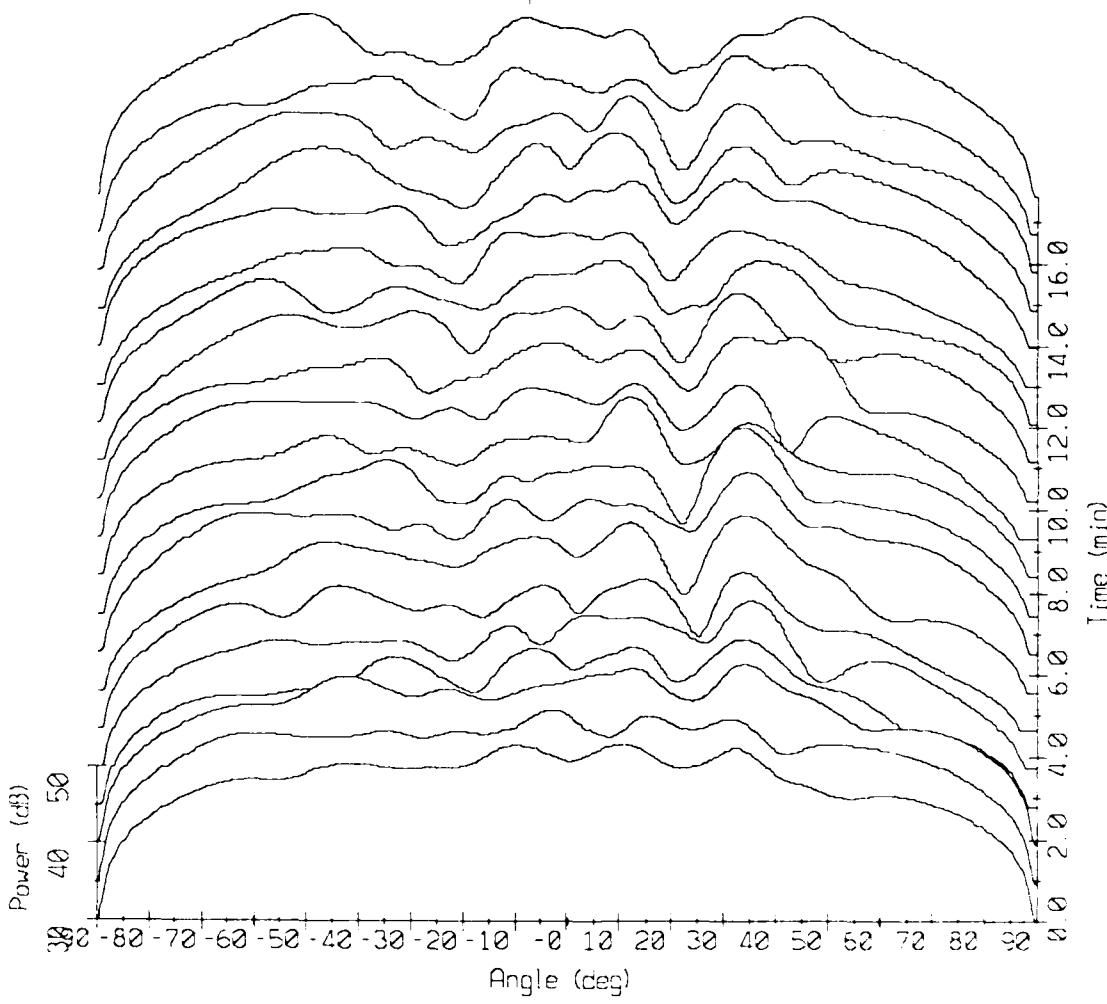




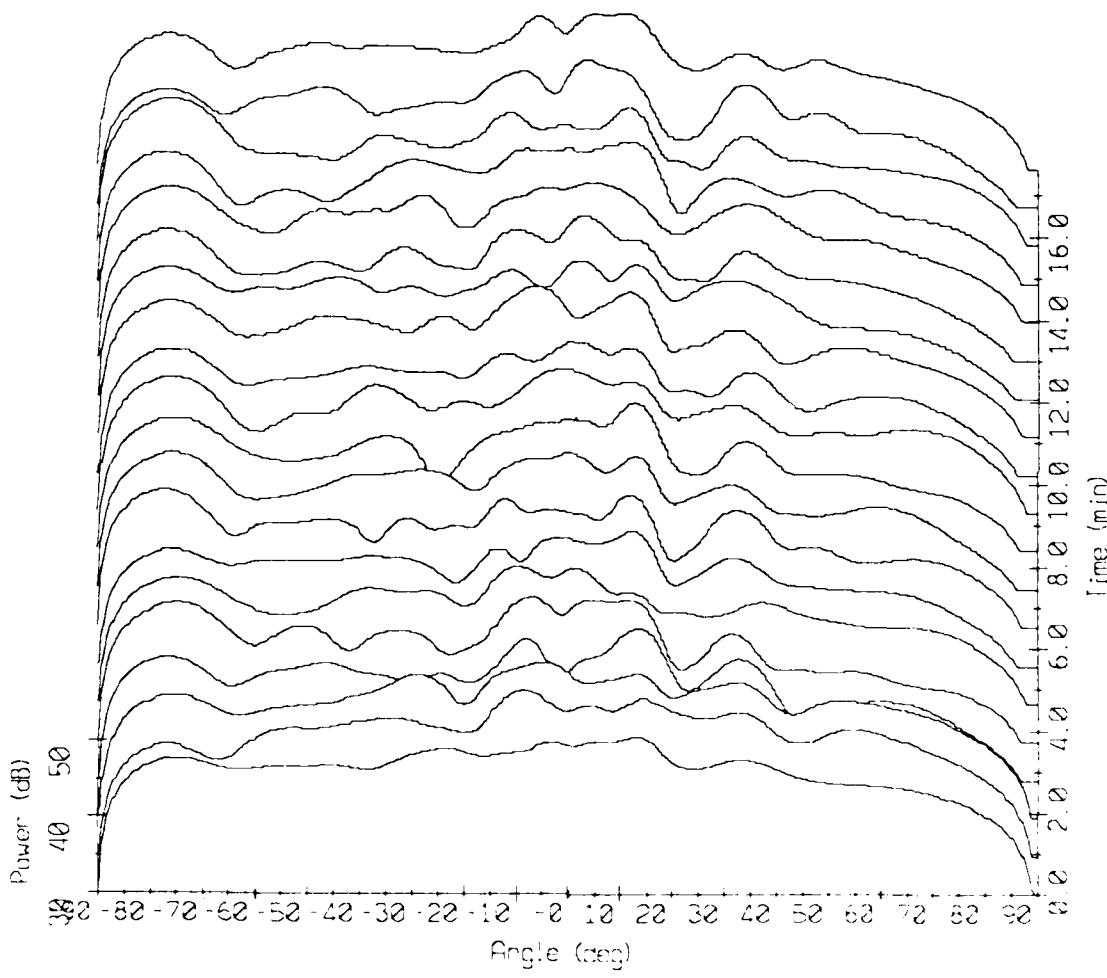
Array Response - 86060 Bin #4967  
 $f = 125$  Hz, KB window ( $\alpha = 1.5$ )



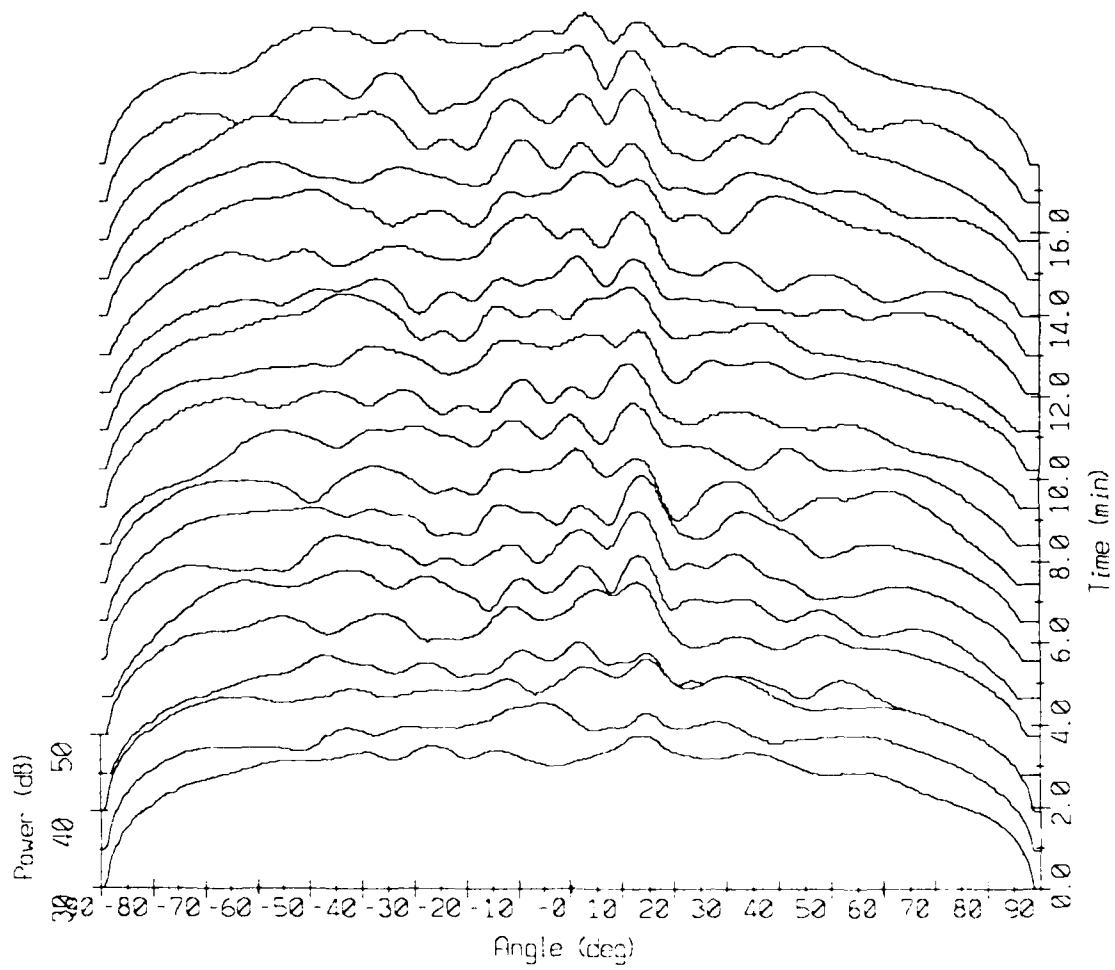
Array Response - 86060 Bin #5141  
 $f = 150$  Hz, KB window ( $\alpha = 1.5$ )



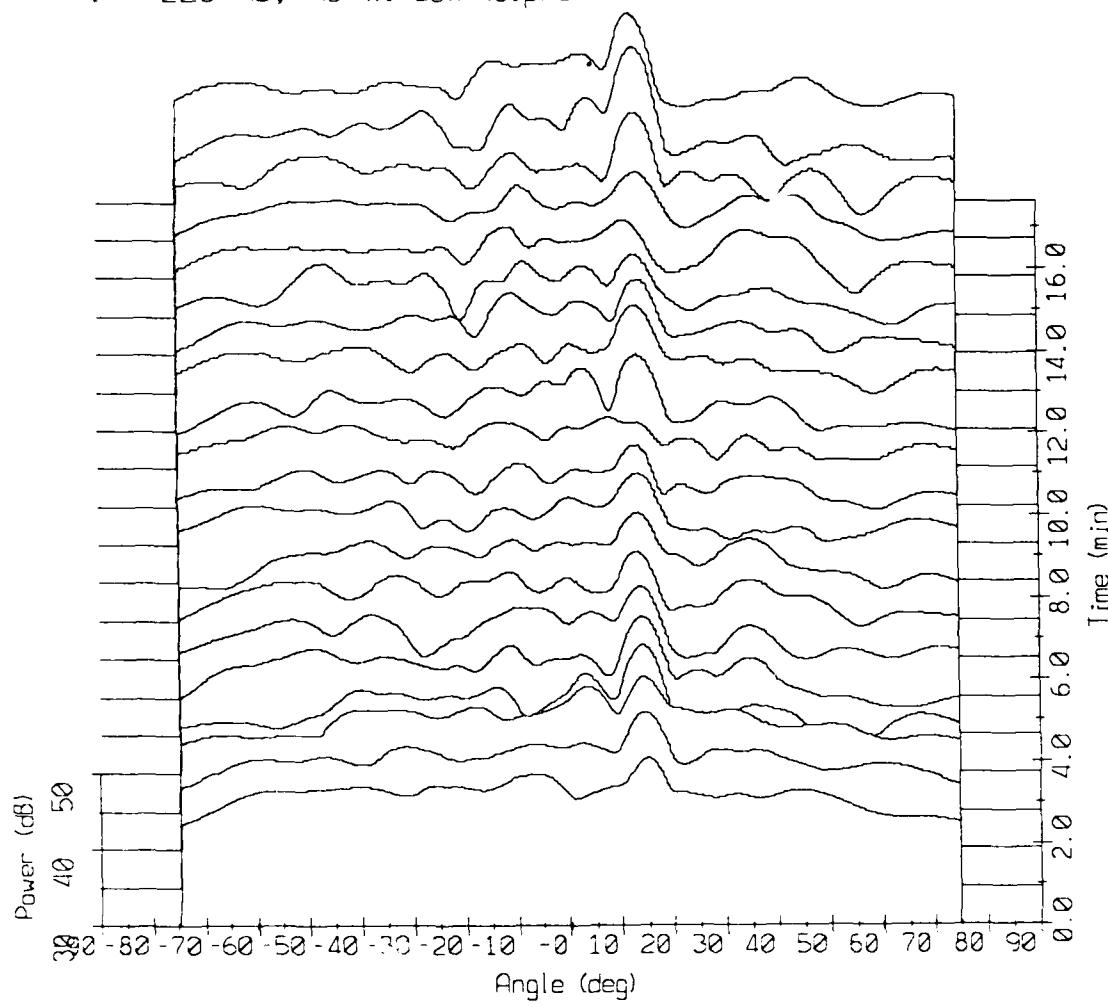
Array Response - 86060 Bin #5316  
 $f = 175$  Hz, KB window ( $\alpha = 1.5$ )



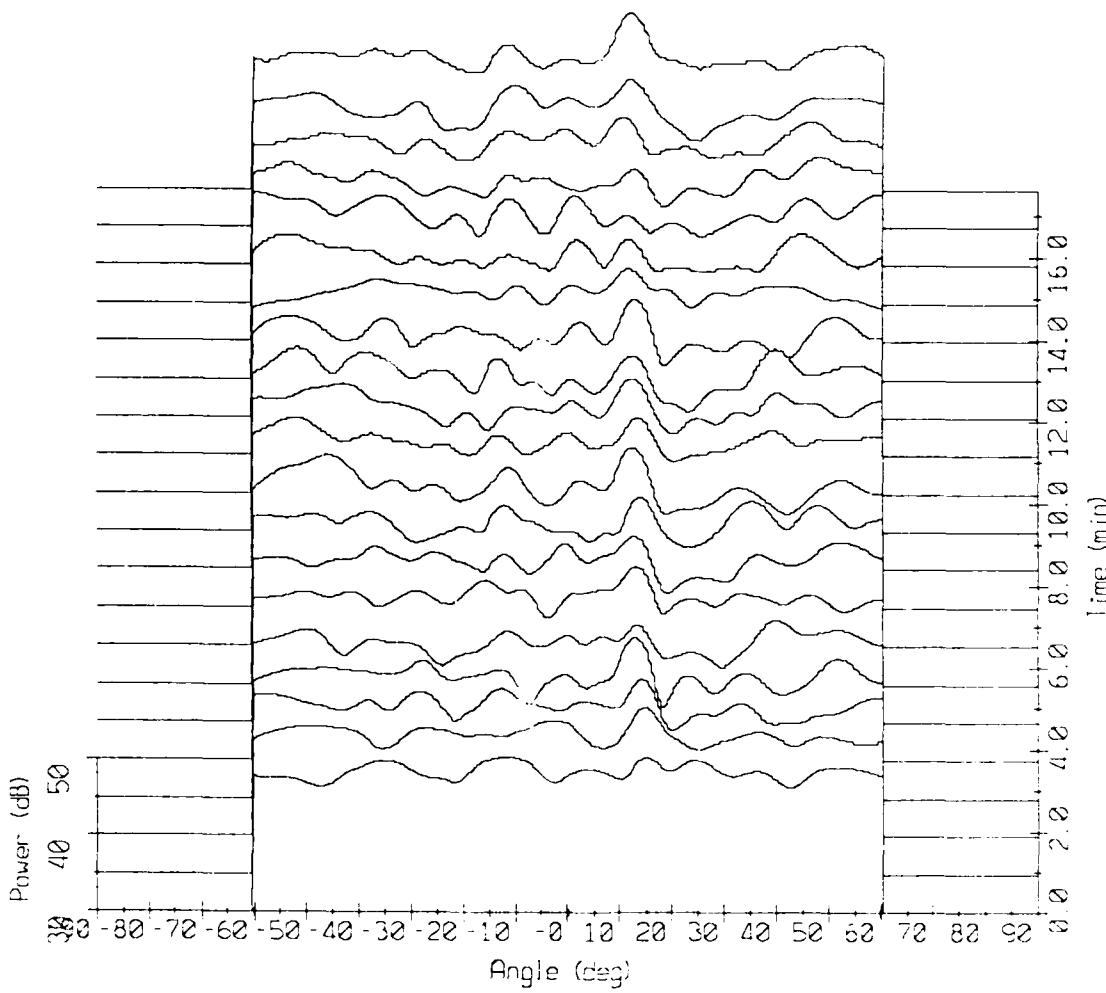
Array Response - 86060 Bin #5490  
 $f = 200$  Hz, KB window ( $\alpha = 1.5$ )



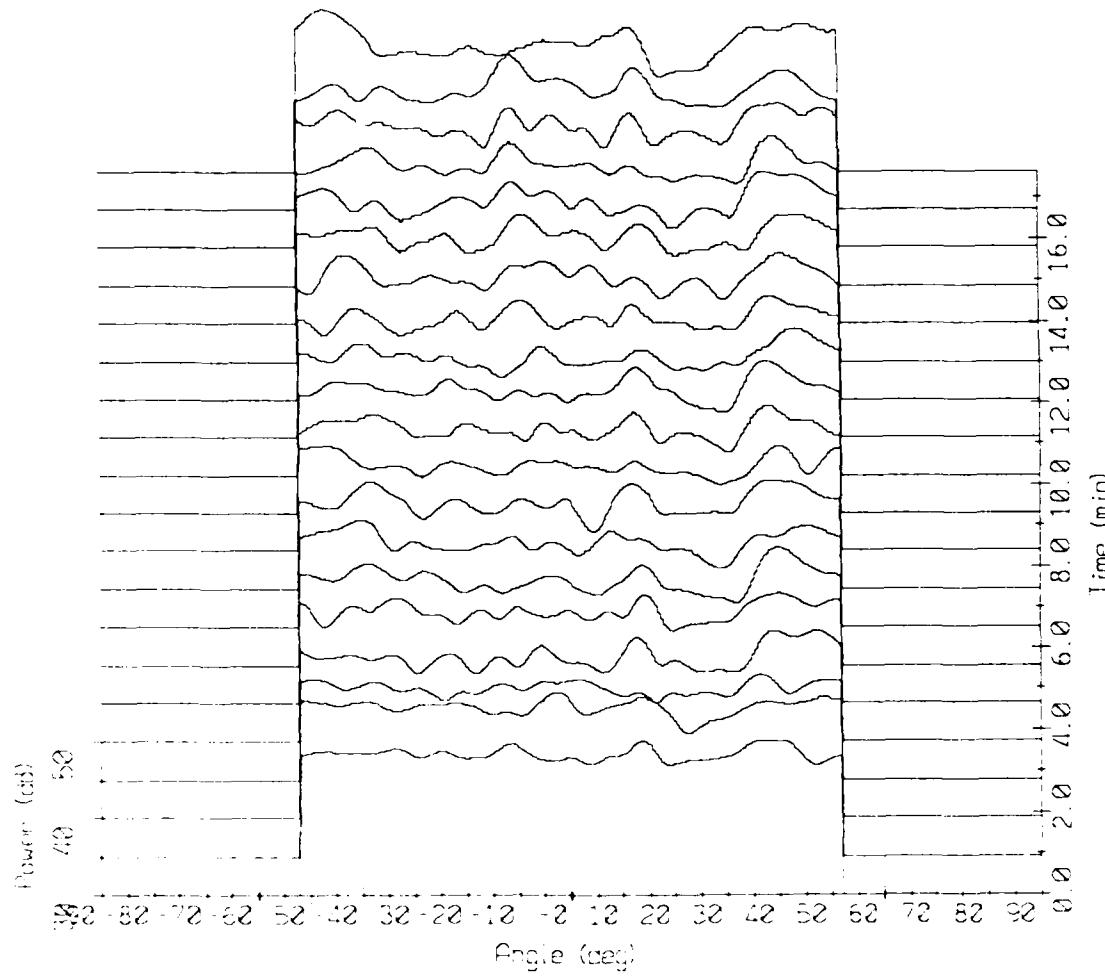
Array Response - 86060 Bin #5664  
 $f = 225$  Hz, KB window ( $\alpha = 1.5$ )



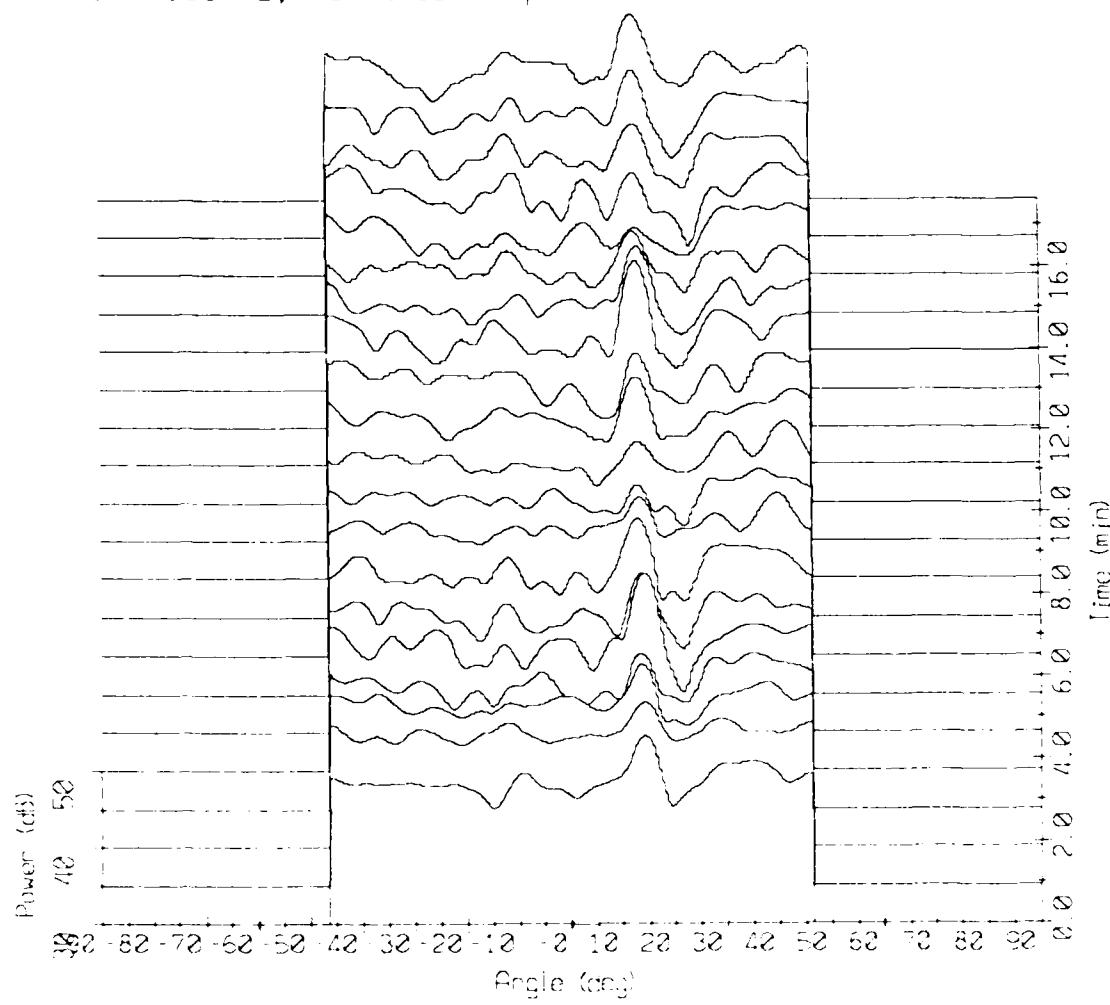
Array Response - 86060 Bin #5832  
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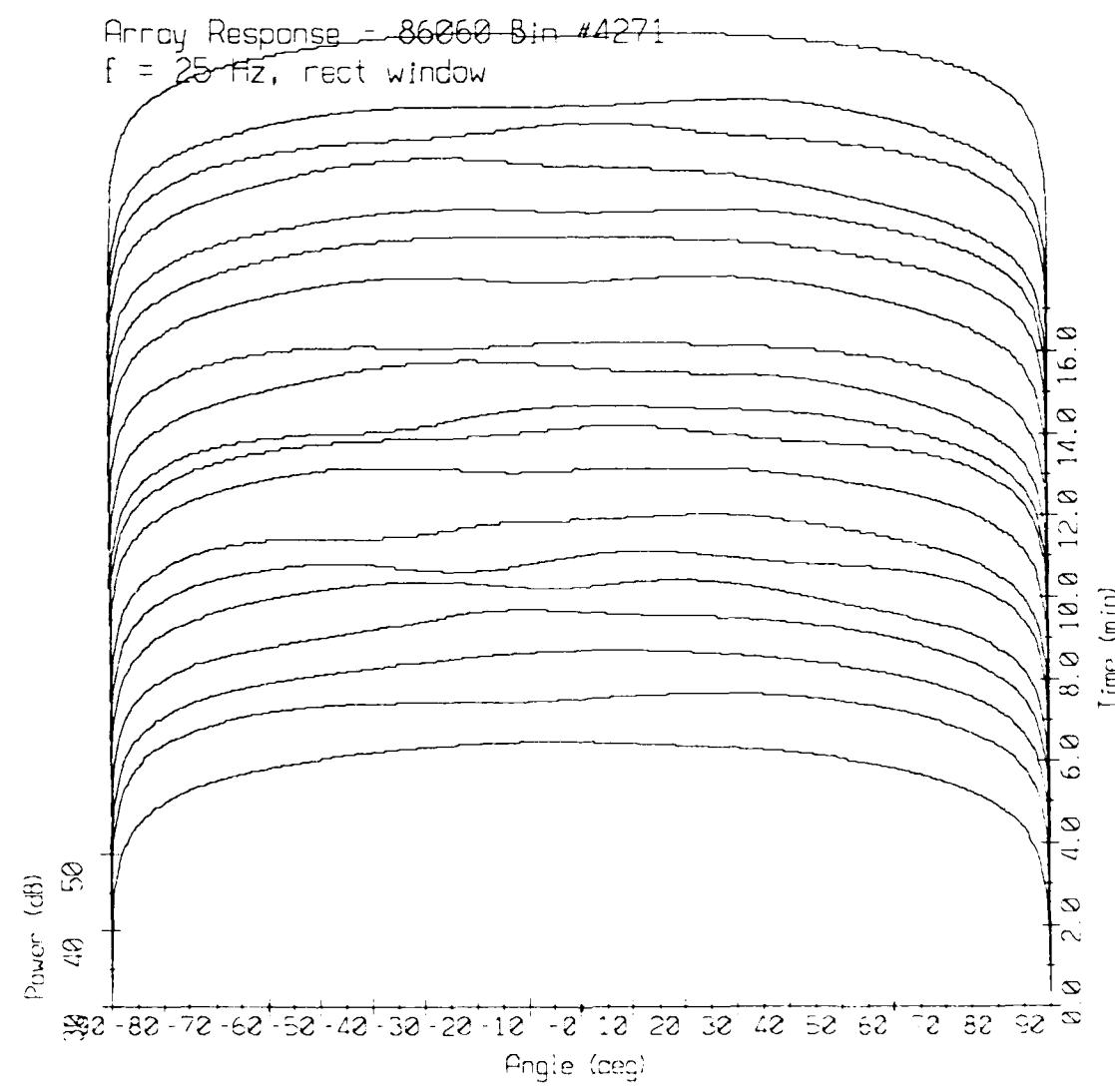
Foray Response - 86060 Bin #6012  
 $f = 275$  Hz, KB window ( $\alpha = 1.5$ )

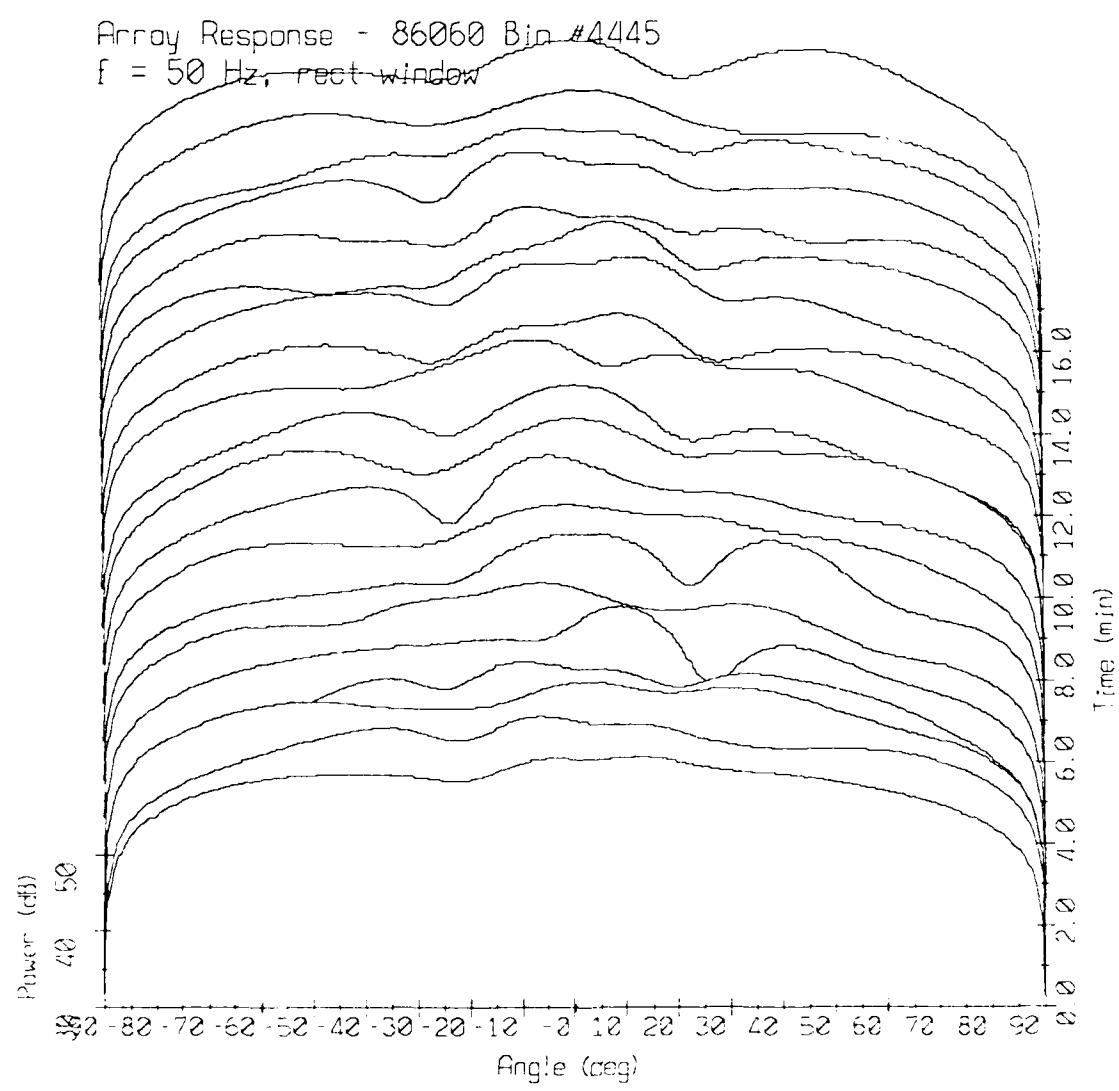


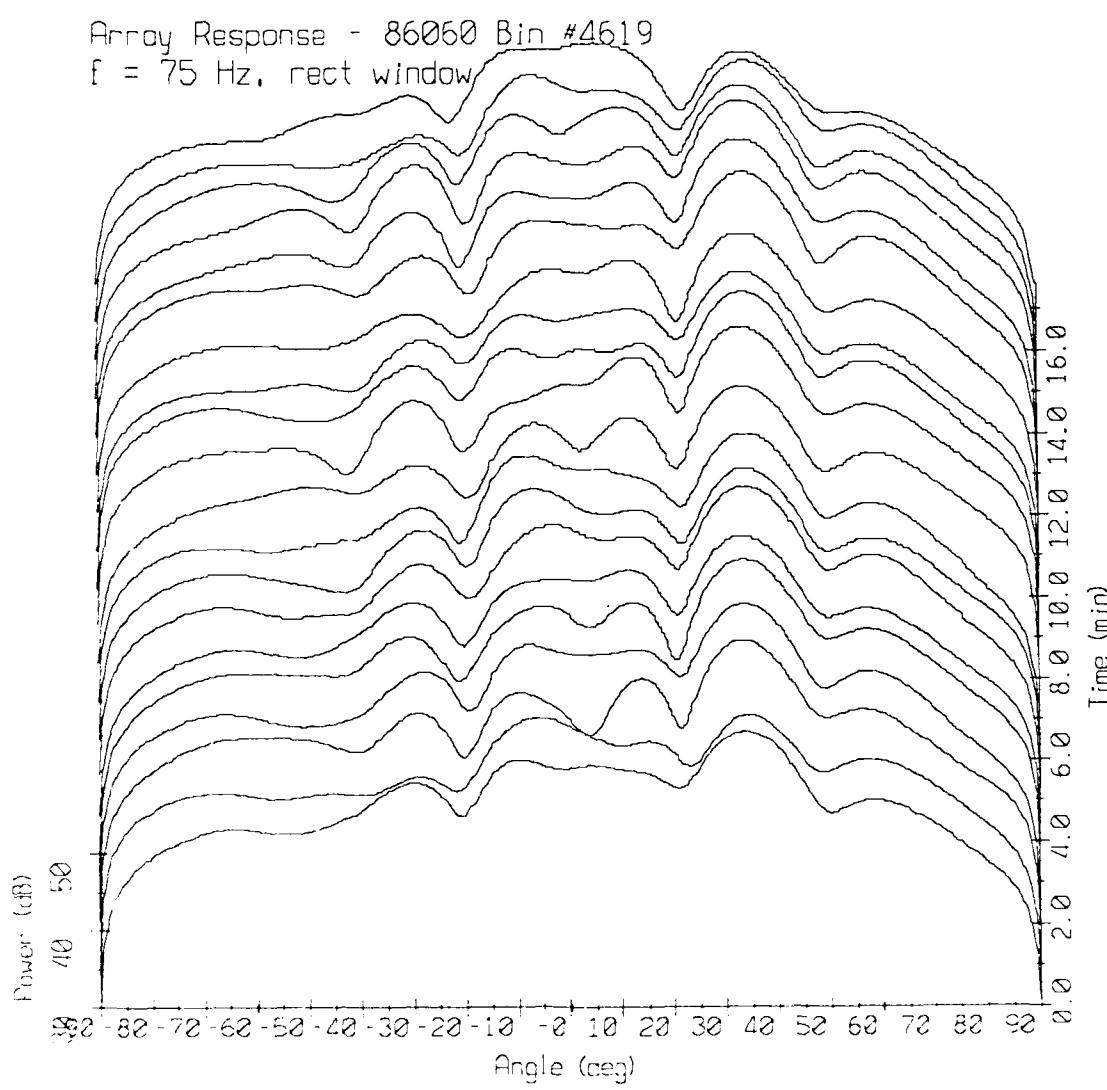
Array Response - 86060 Bin #6186  
f = 320 Hz, KB window (alpha = 1.5)

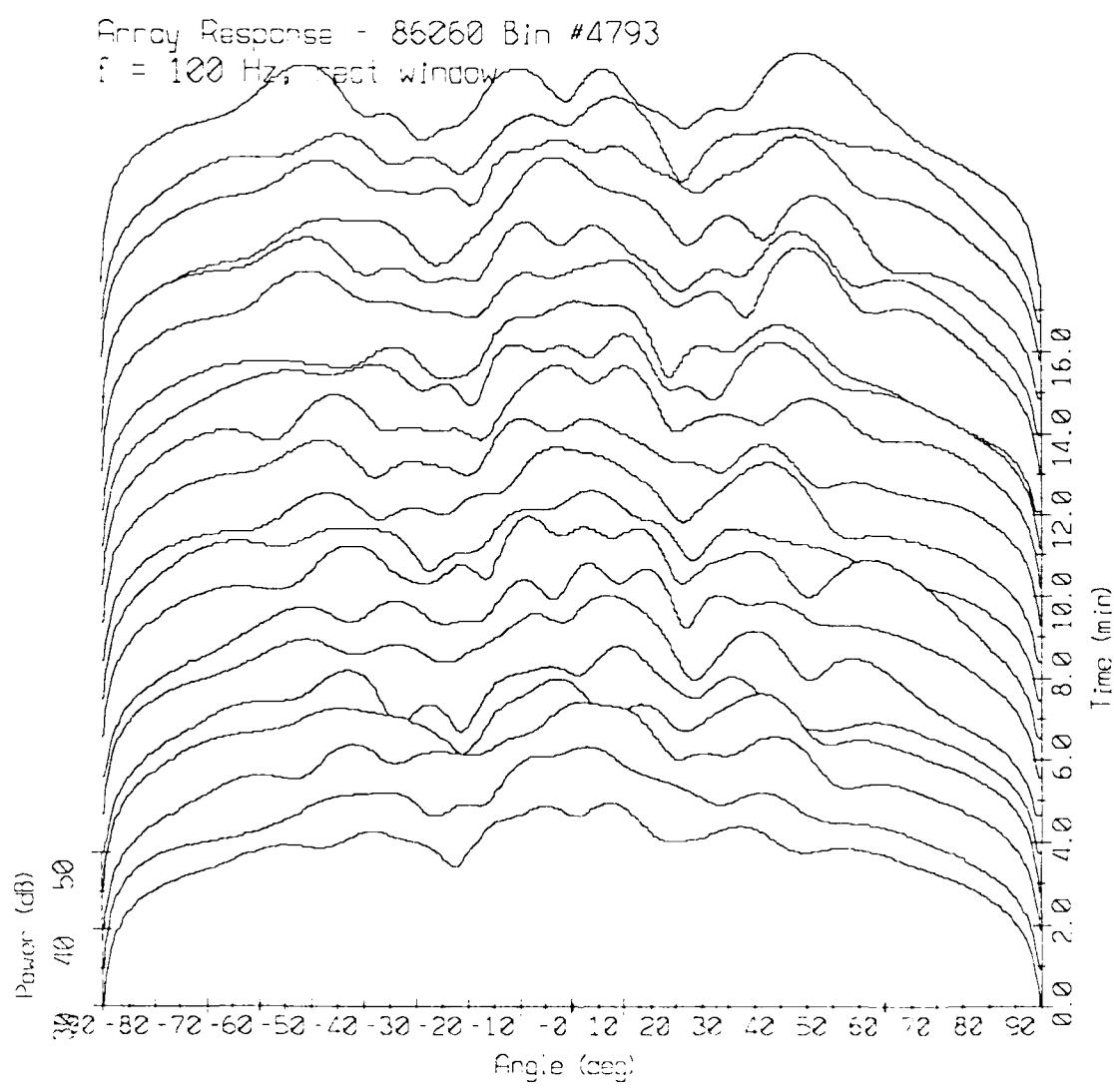


V. Array Response: Waterfall, Rect Window.

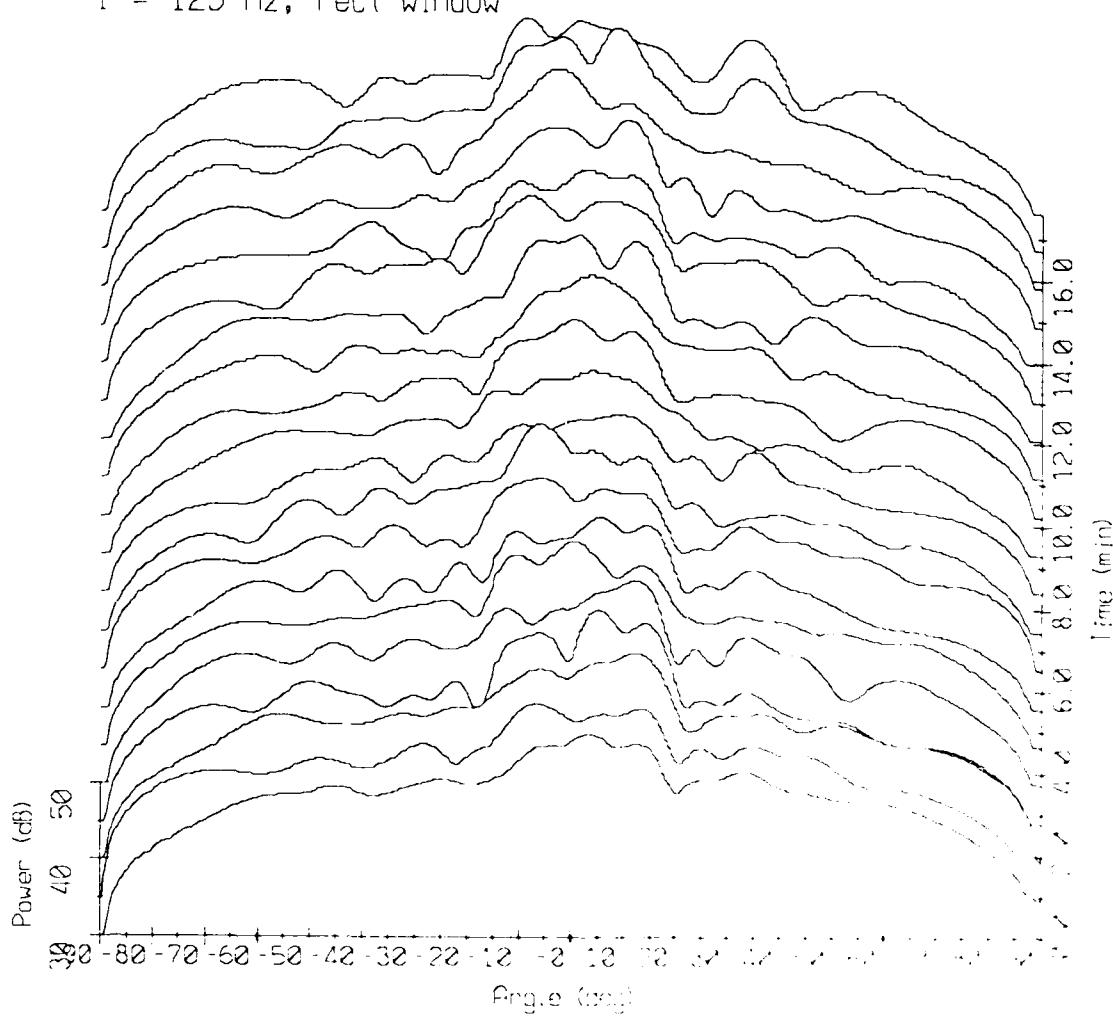




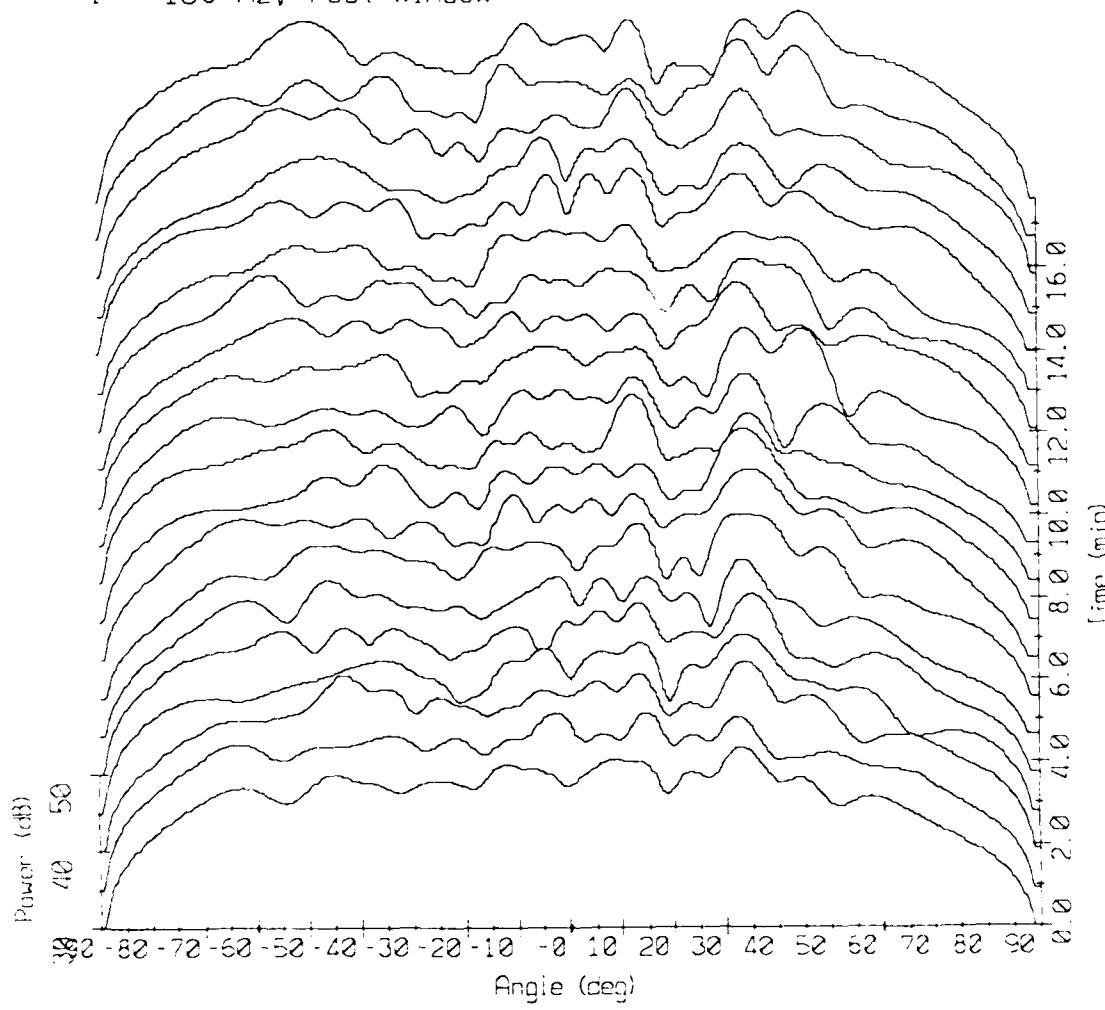




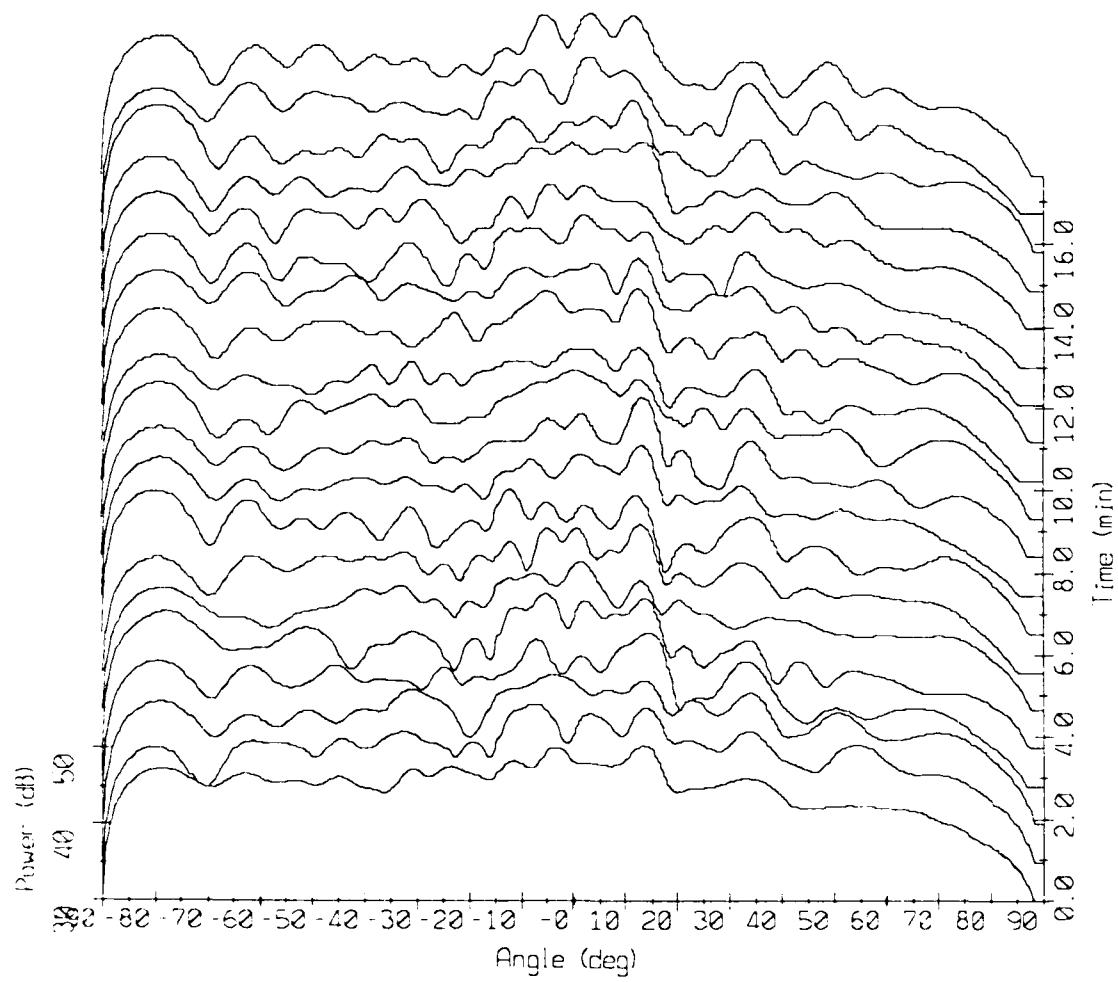
Array Response - 86060 Bin #4967  
 $f = 125$  Hz, rect window



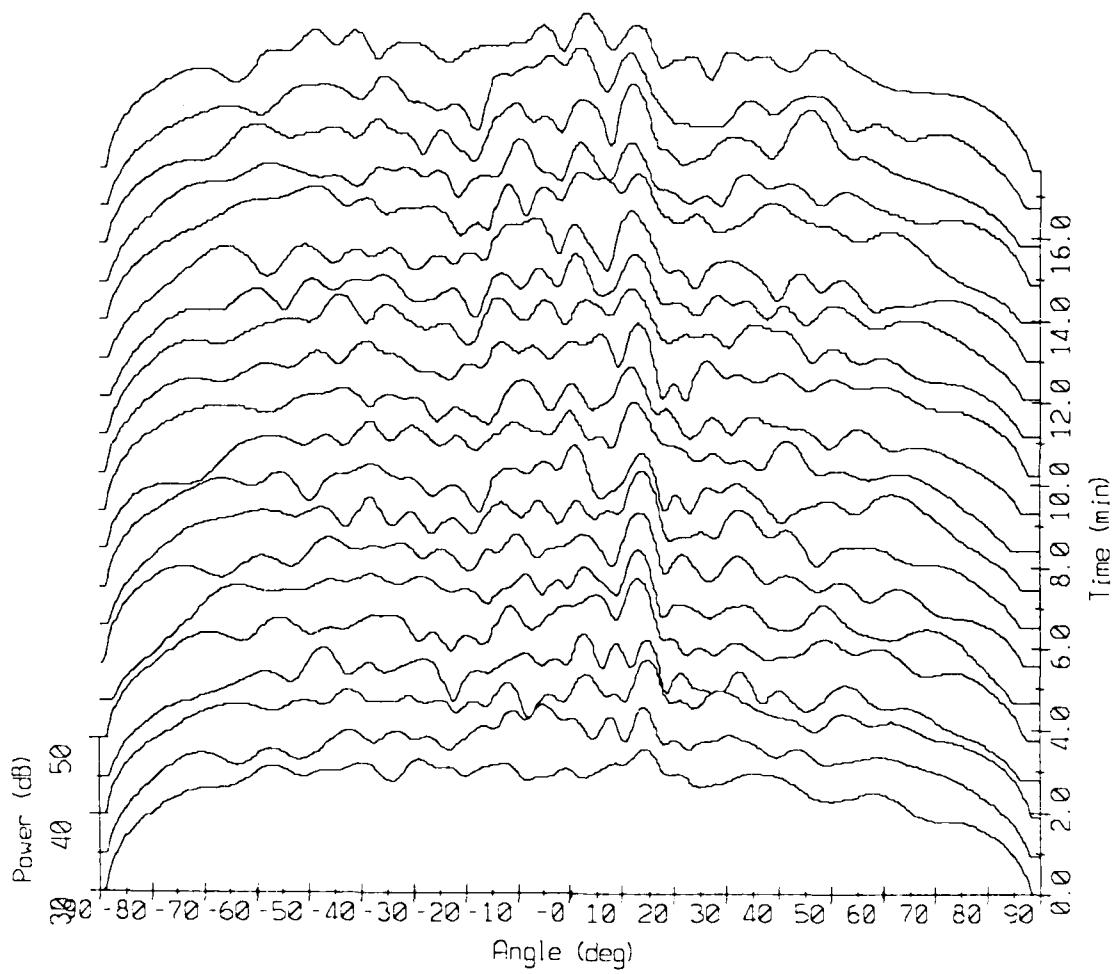
Array Response - 86060 Bin #5141  
 $f = 150$  Hz, rect window



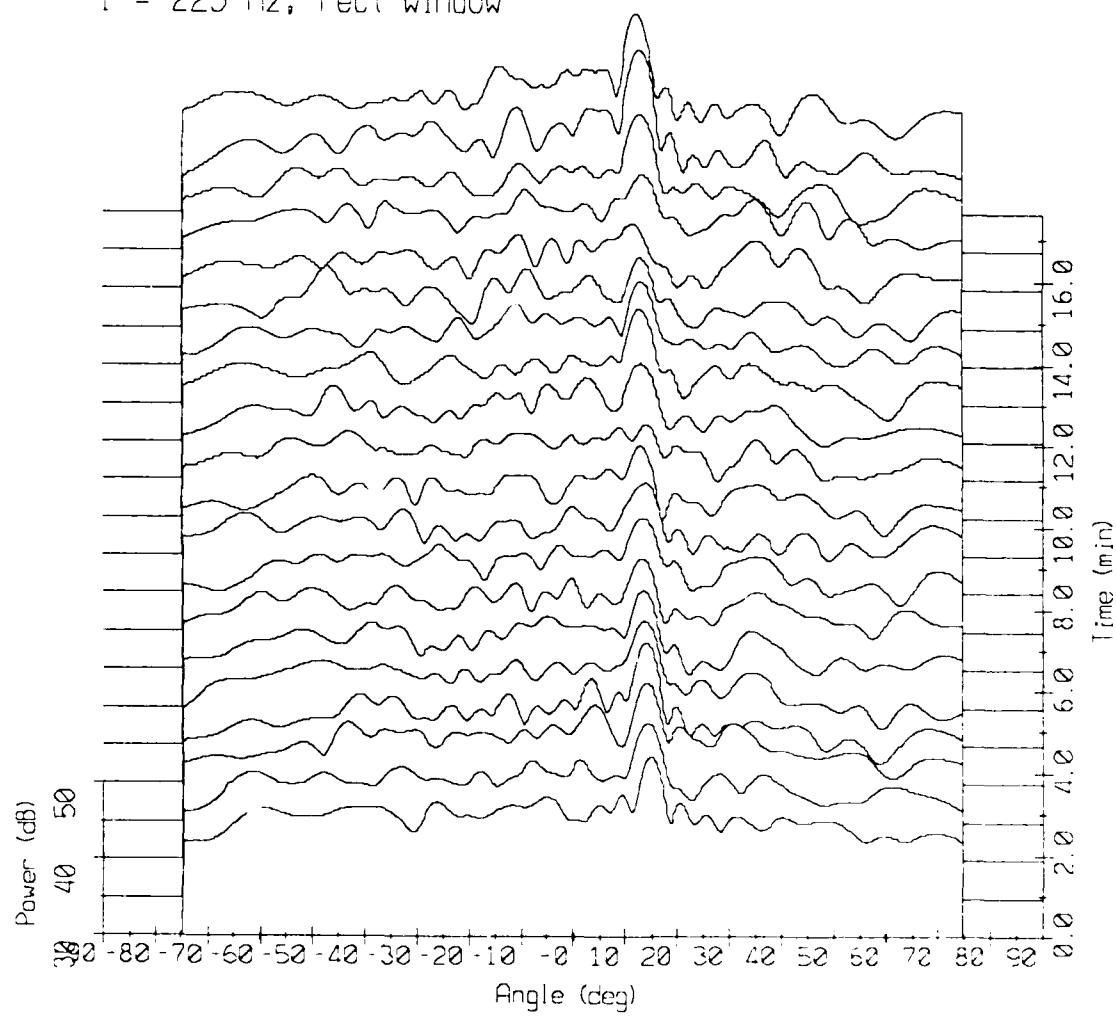
Array Response - 86060 Bin #5316  
 $f = 175$  Hz, rect window



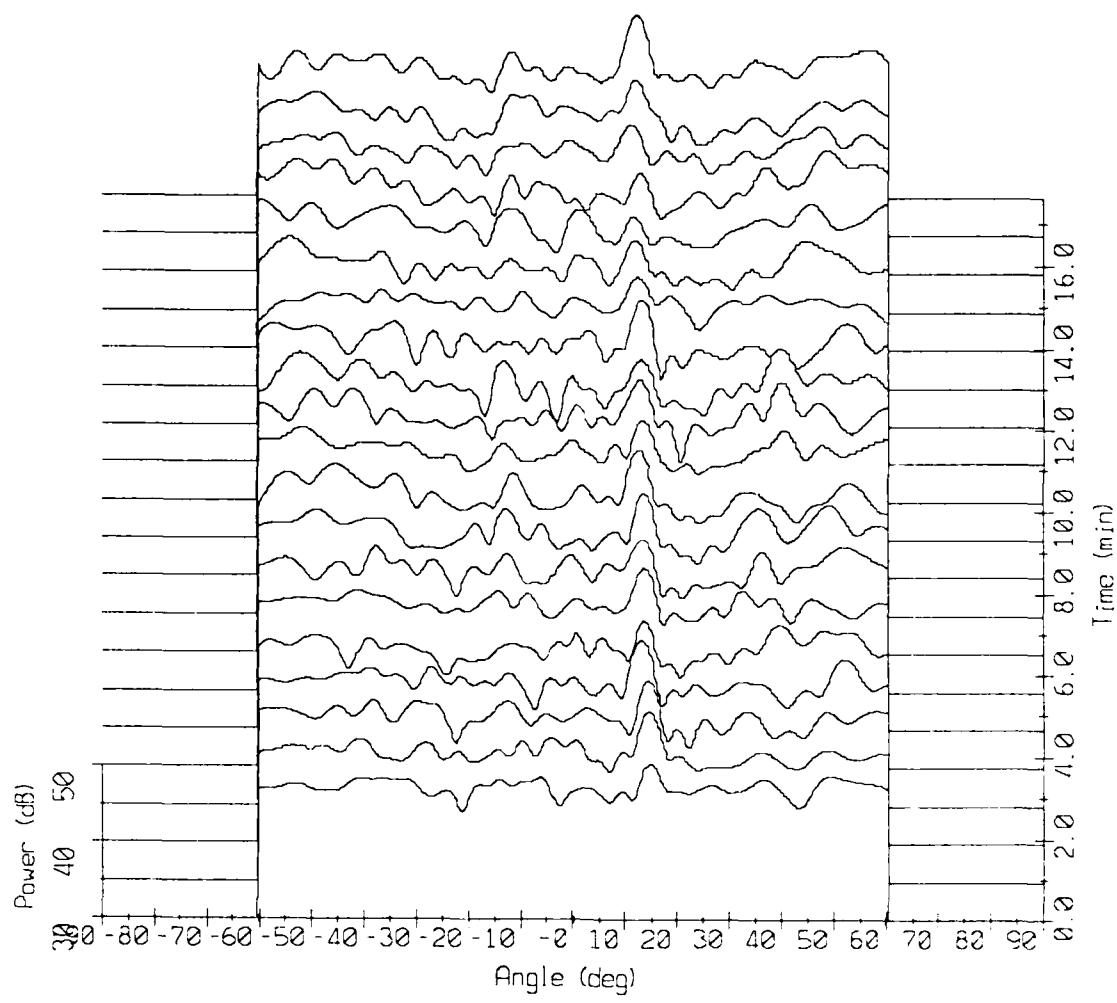
Array Response - 86060 Bin #5490  
 $f = 200$  Hz, rect window



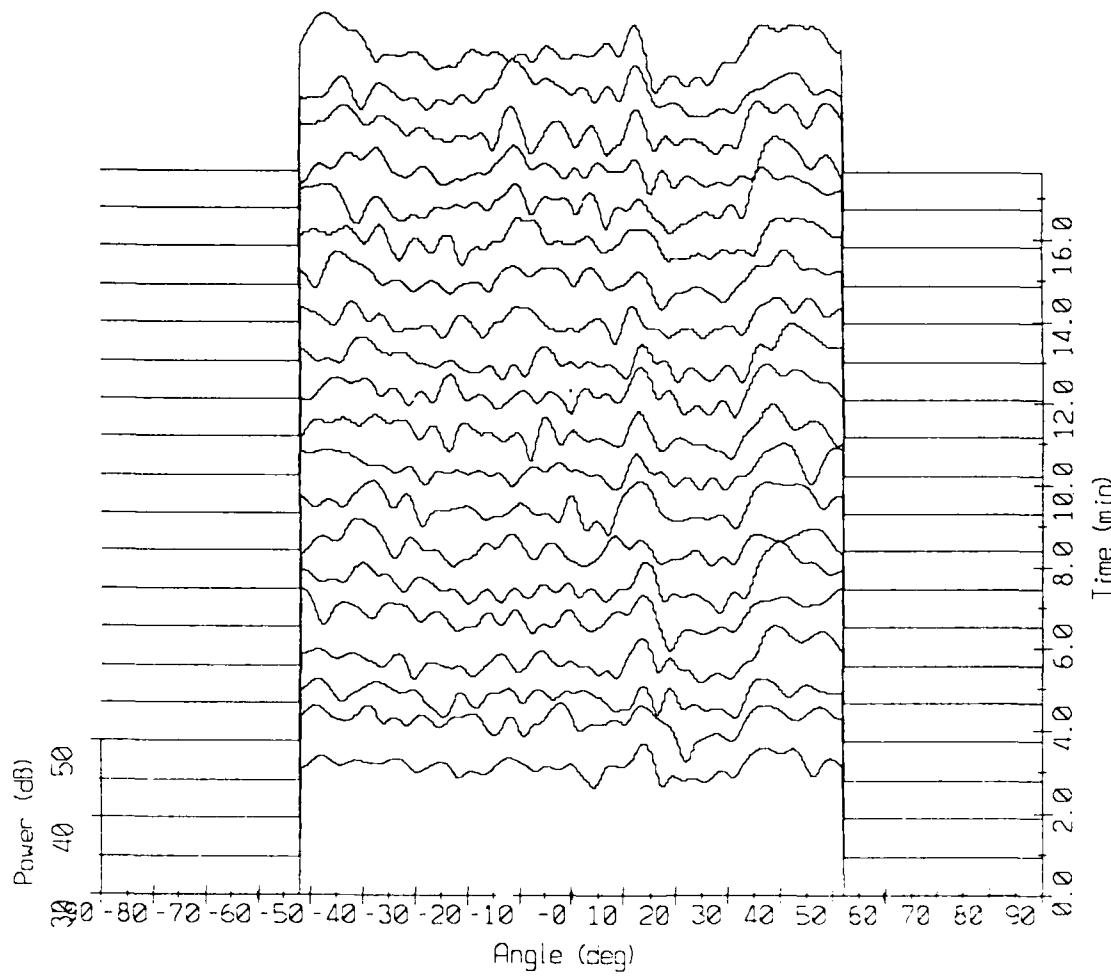
Array Response - 86060 Bin #5664  
 $f = 225$  Hz, rect window



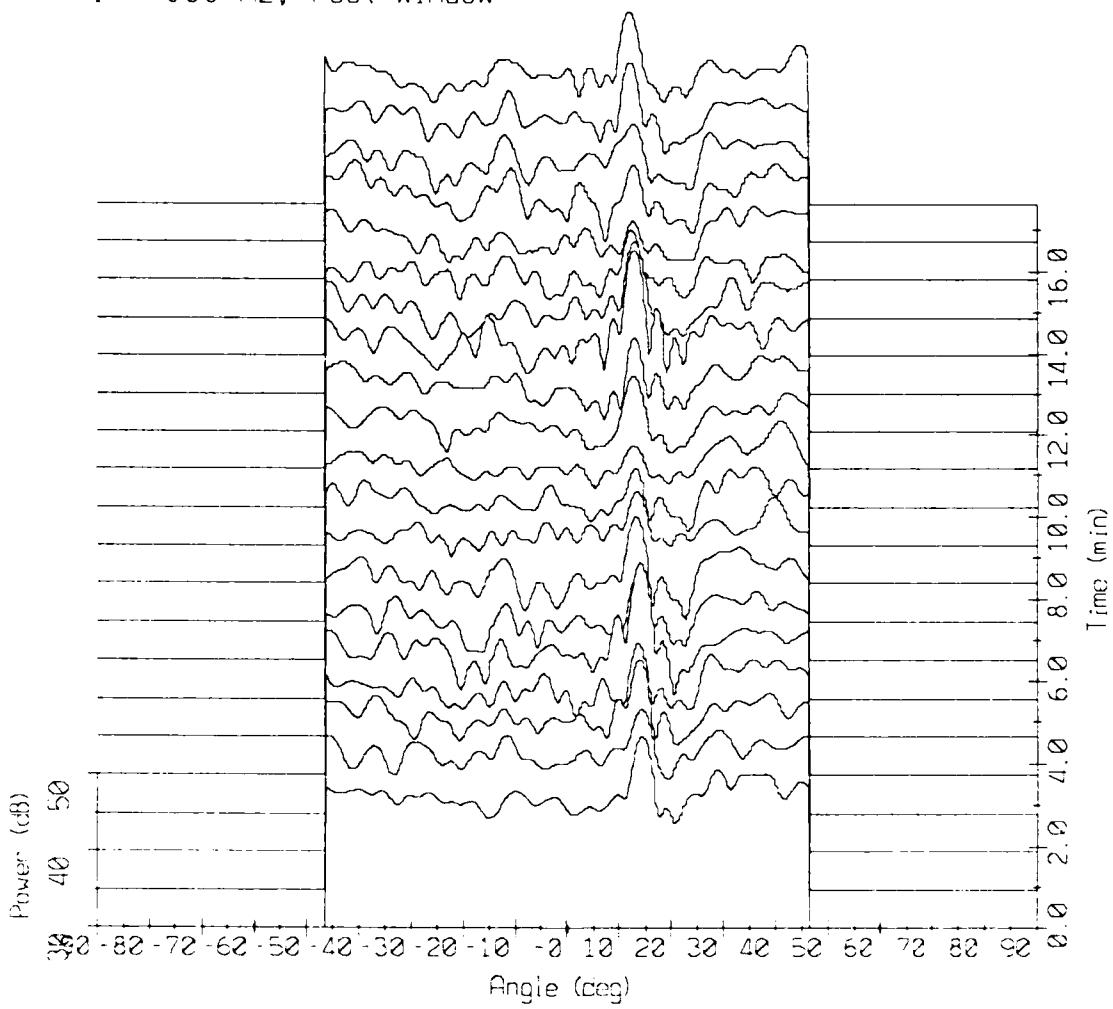
Array Response - 86060 Bin #5832  
 $f = 250$  Hz, rect window



Array Response - 86060 Bin #6012  
 $f = 275$  Hz, rect window



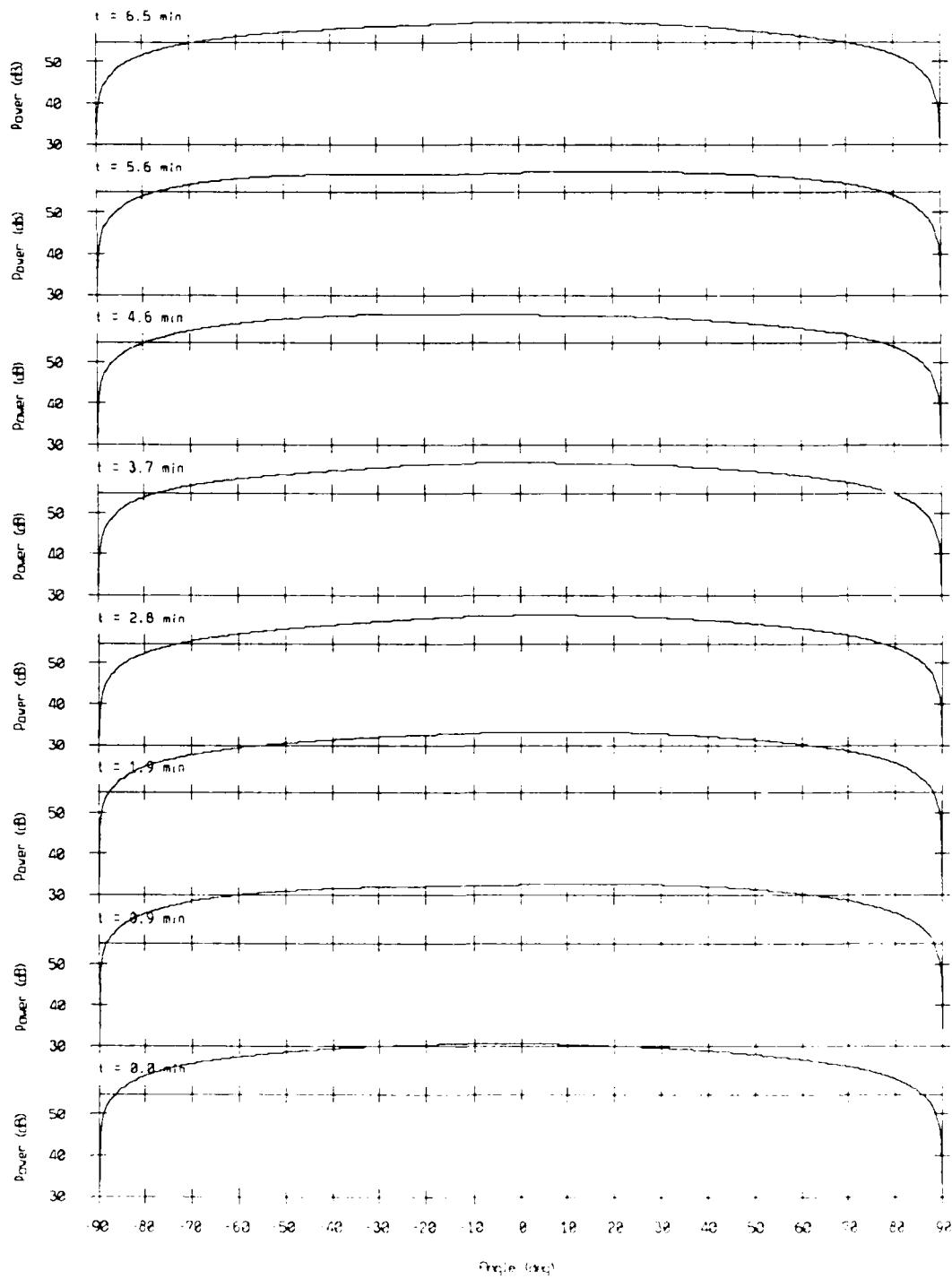
Array Response - 86060 Bin #6186  
 $f = 300$  Hz, rect window



**VI. Array Response: Panels, KB Window.**

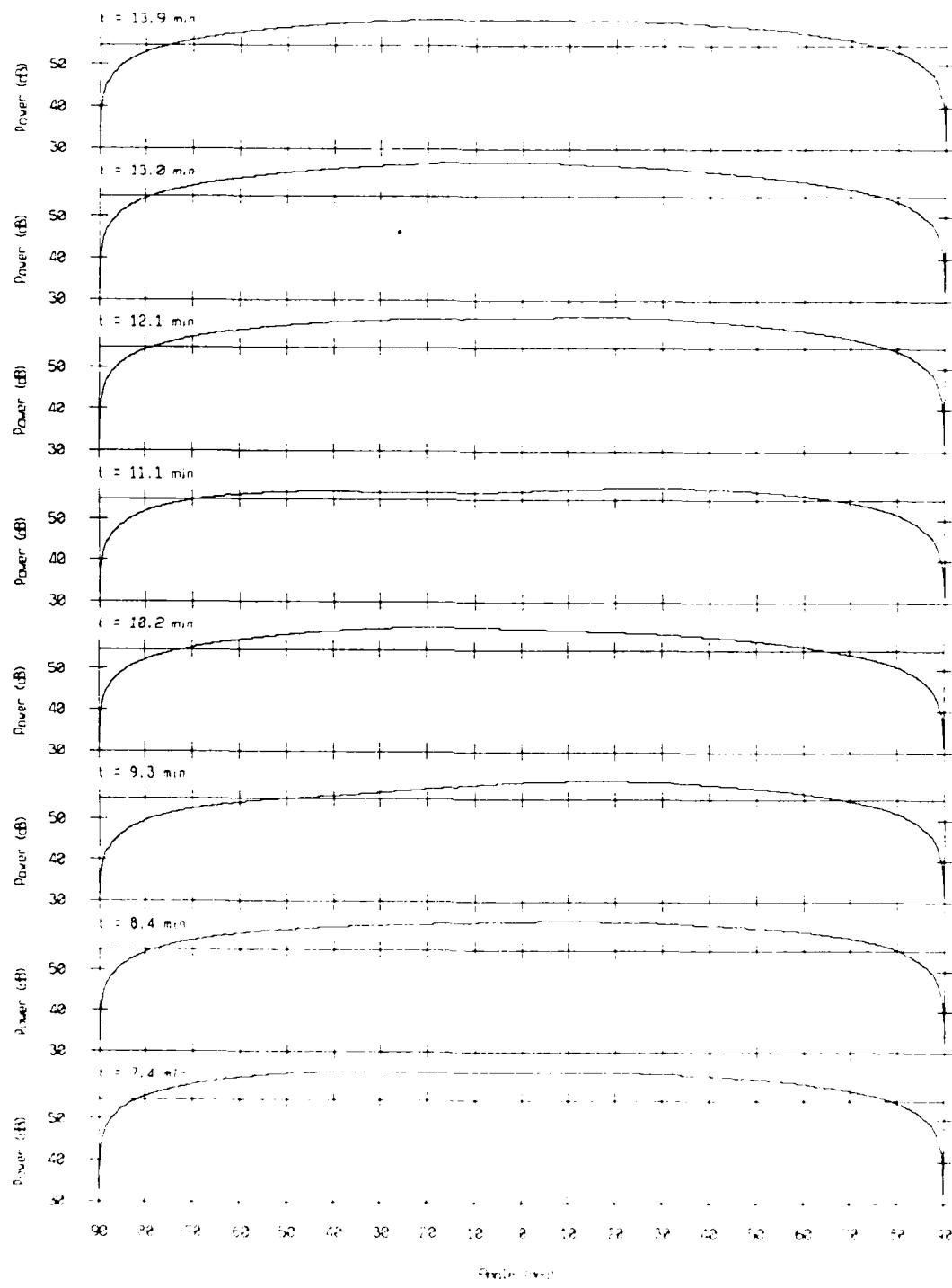
Array Response - 86060 Bin #4271

$f = 25$  Hz, KB window ( $\alpha = 1.5$ )

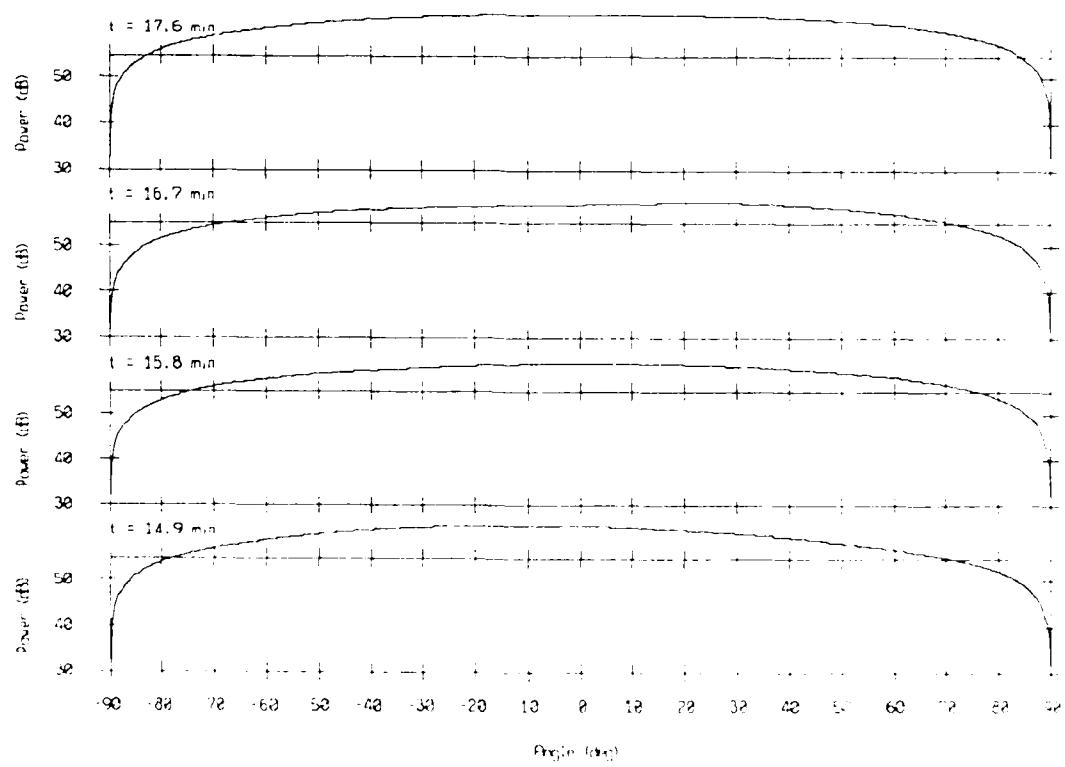


Array Response - 85262 Bin #4271

f = 25 Hz, KB window (alpha = 1.5)

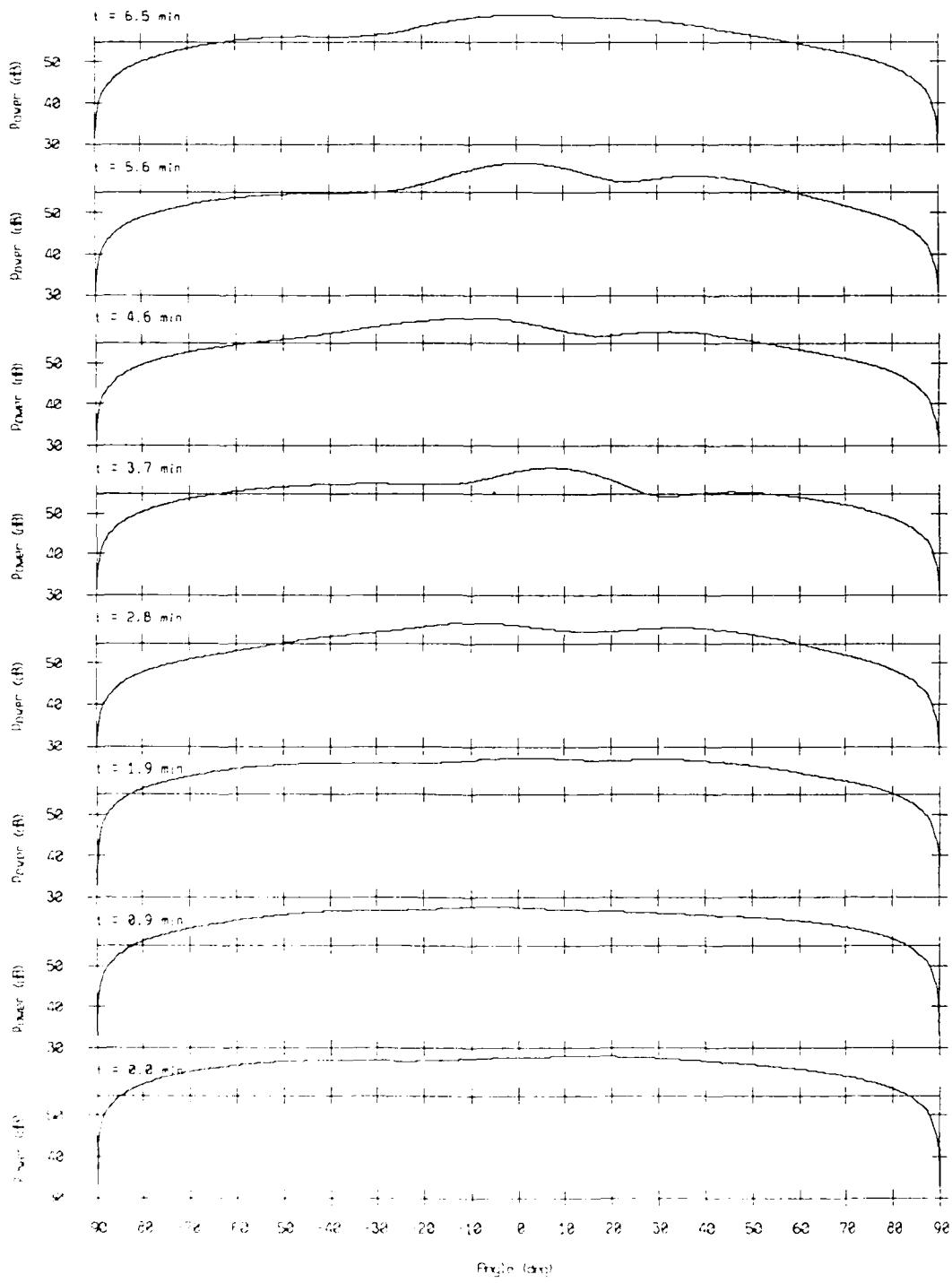


Array Response - 86060 Bin #4271  
 $f = 25$  Hz, KB window ( $\alpha_{phc} = 1.5$ )



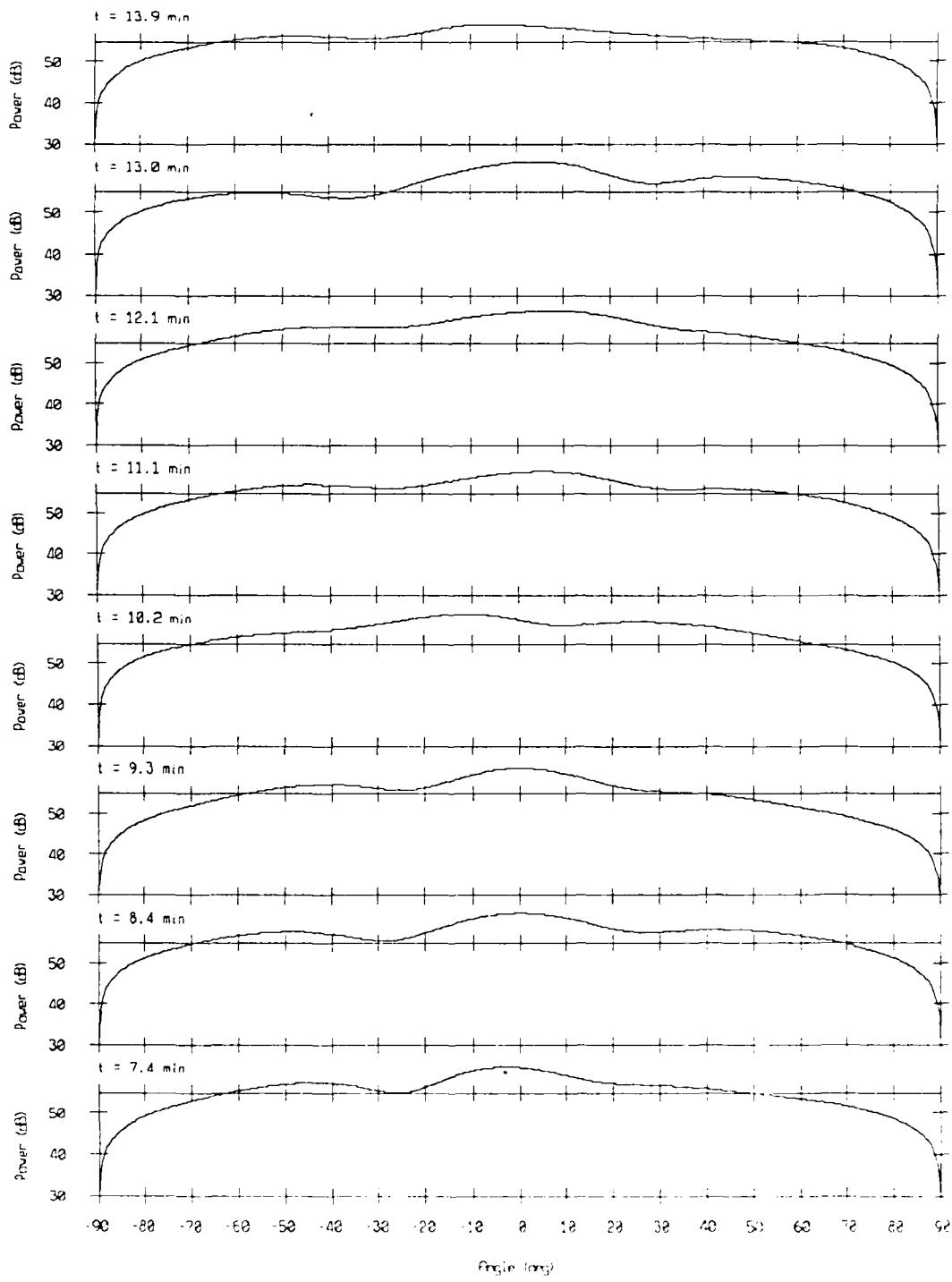
Array Response - 86060 Bin #4445

$f = 50$  Hz, KB window ( $\alpha = 1.5$ )



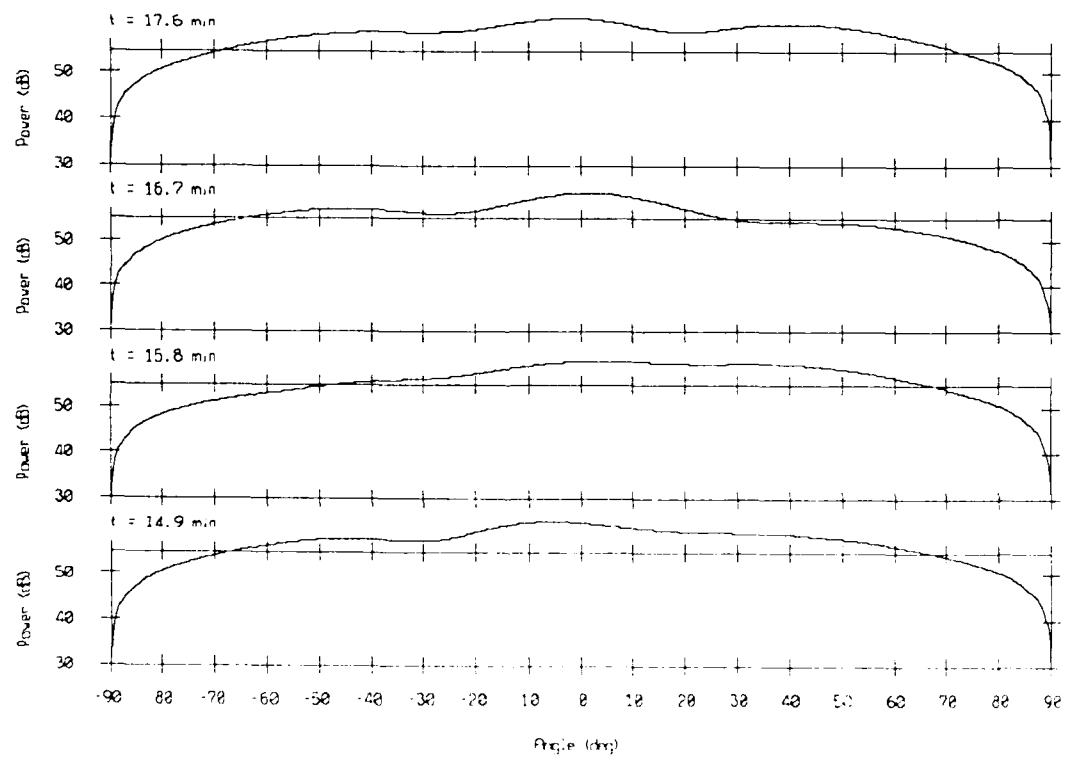
Array Response - 86060 Bin #4445

$f = 50$  Hz, KB window ( $\alpha$  = 1.5)



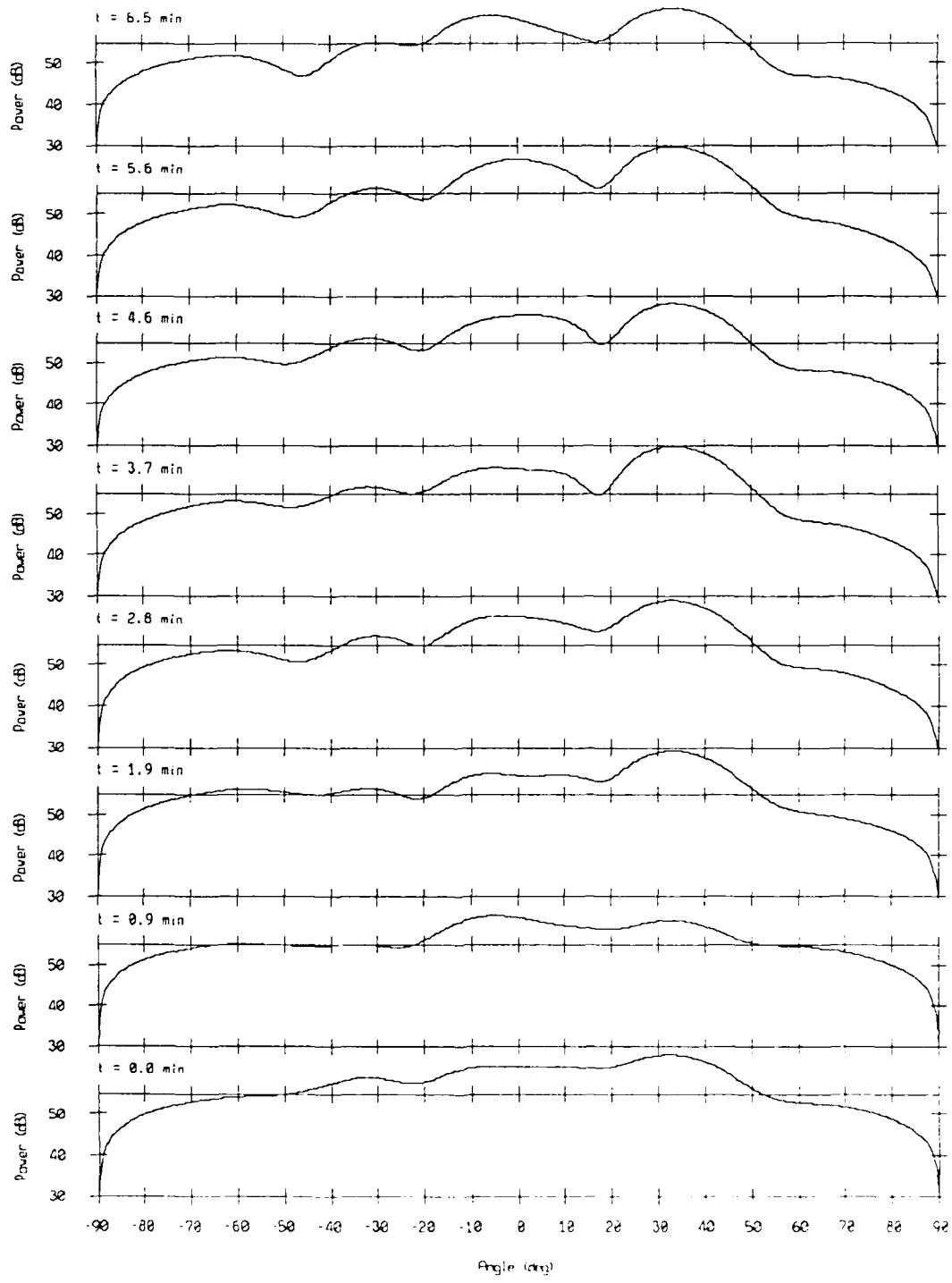
Array Response - 86060 Bin #4445

f = 50 Hz, KB window (alpha = 1.5)



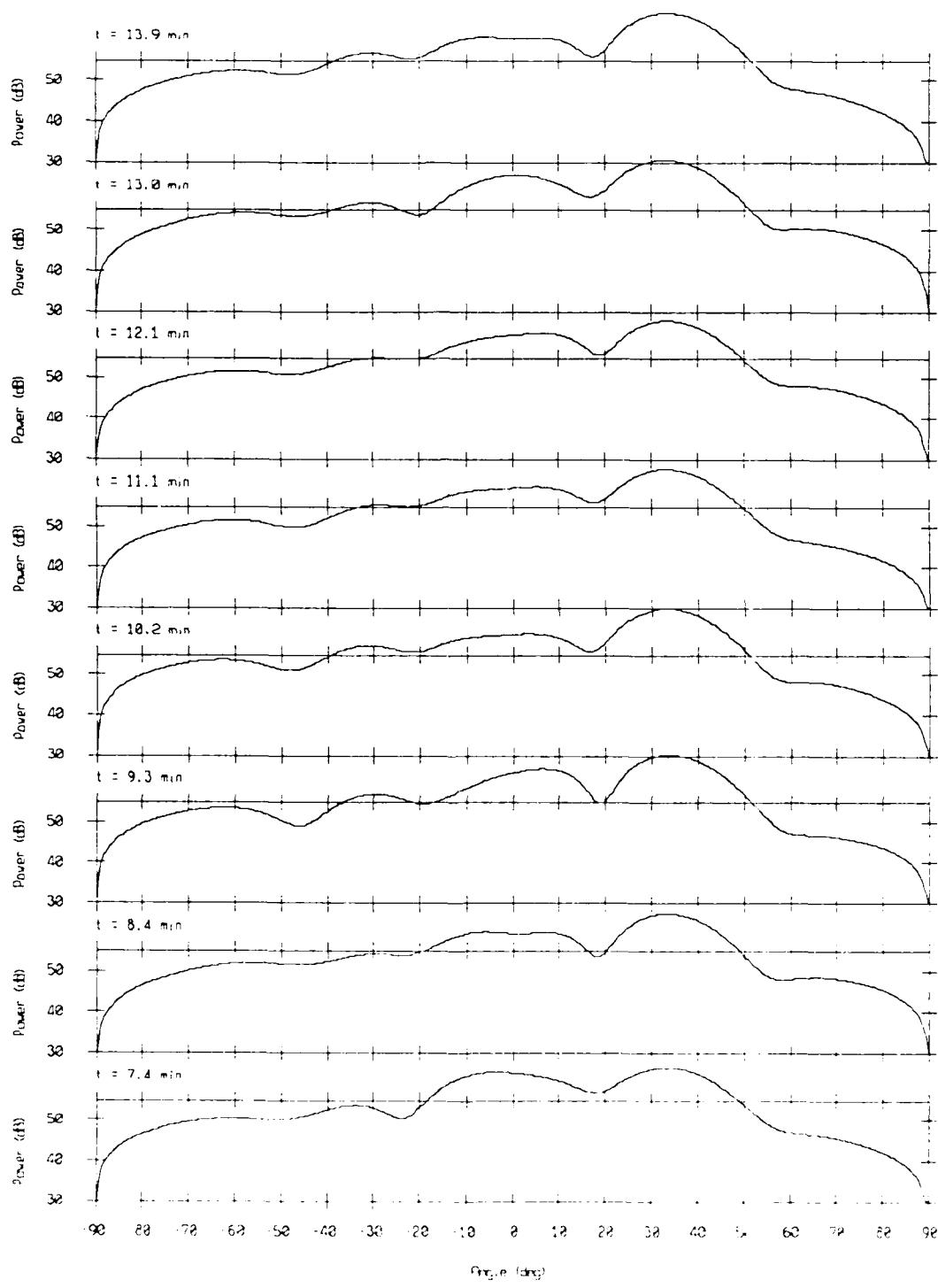
Array Response - 86060 Bin #4519

$f = 75$  Hz, KB window ( $\alpha = 1.5$ )

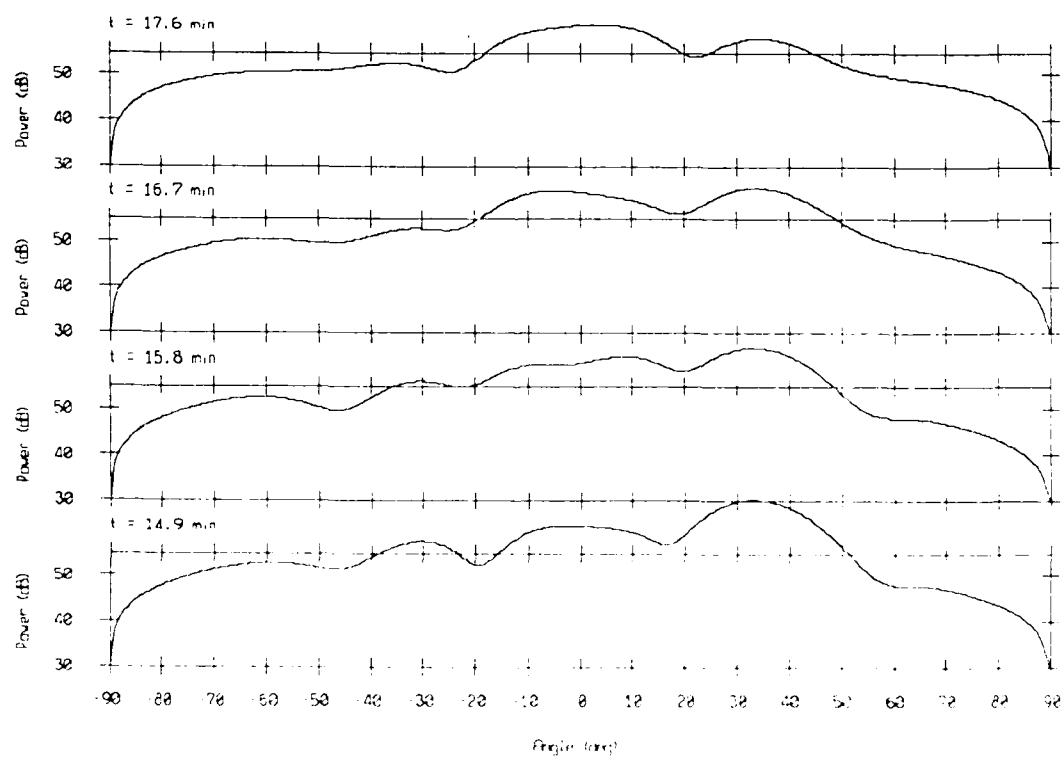


Array Response - 86260 Bin #4619

$f = 75$  Hz, KB window ( $\alpha = 1.5$ )

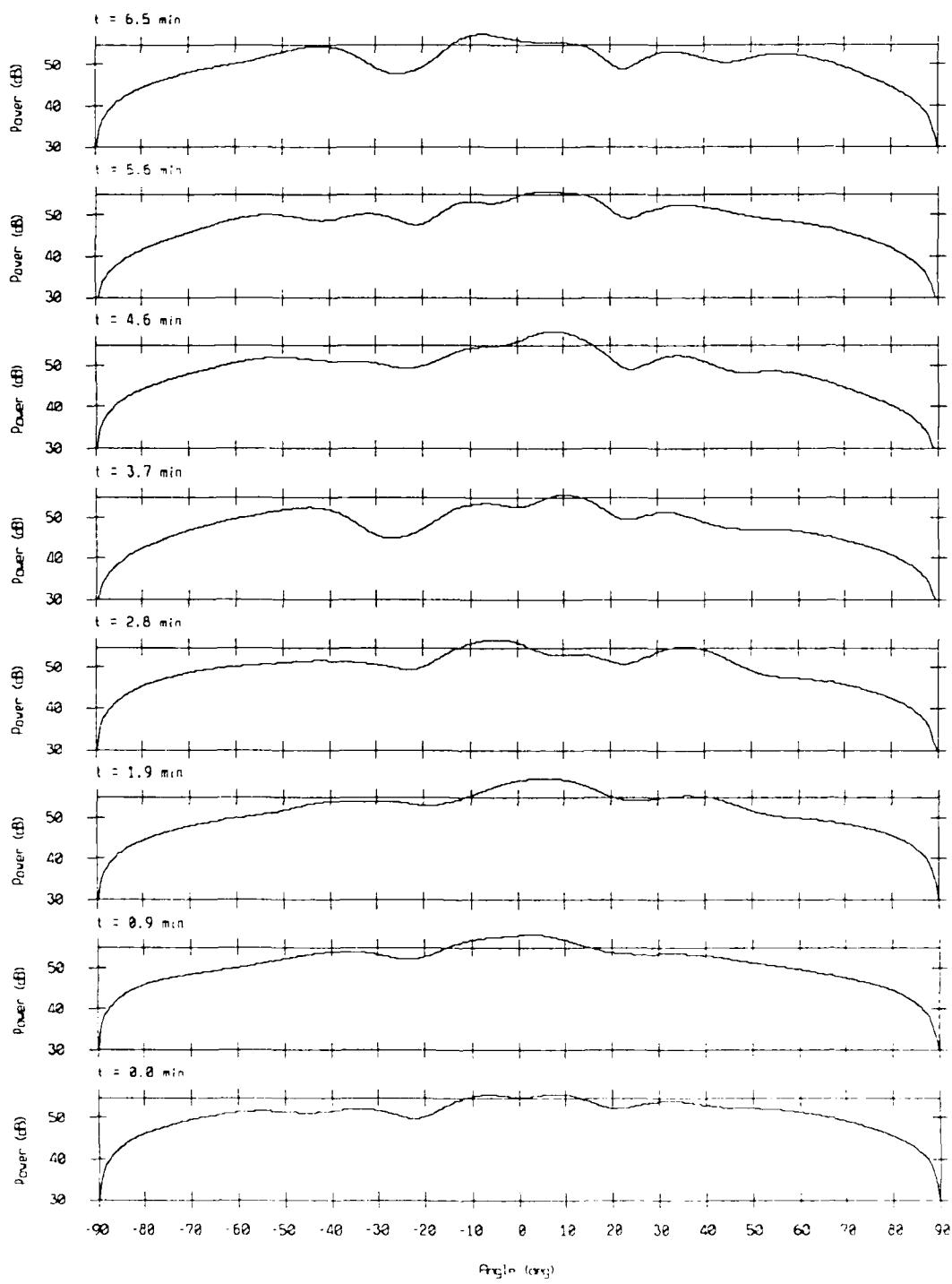


Array Response - 86060 Bin #4619  
 $f = 75$  Hz, KB window ( $\alpha = 1.5$ )



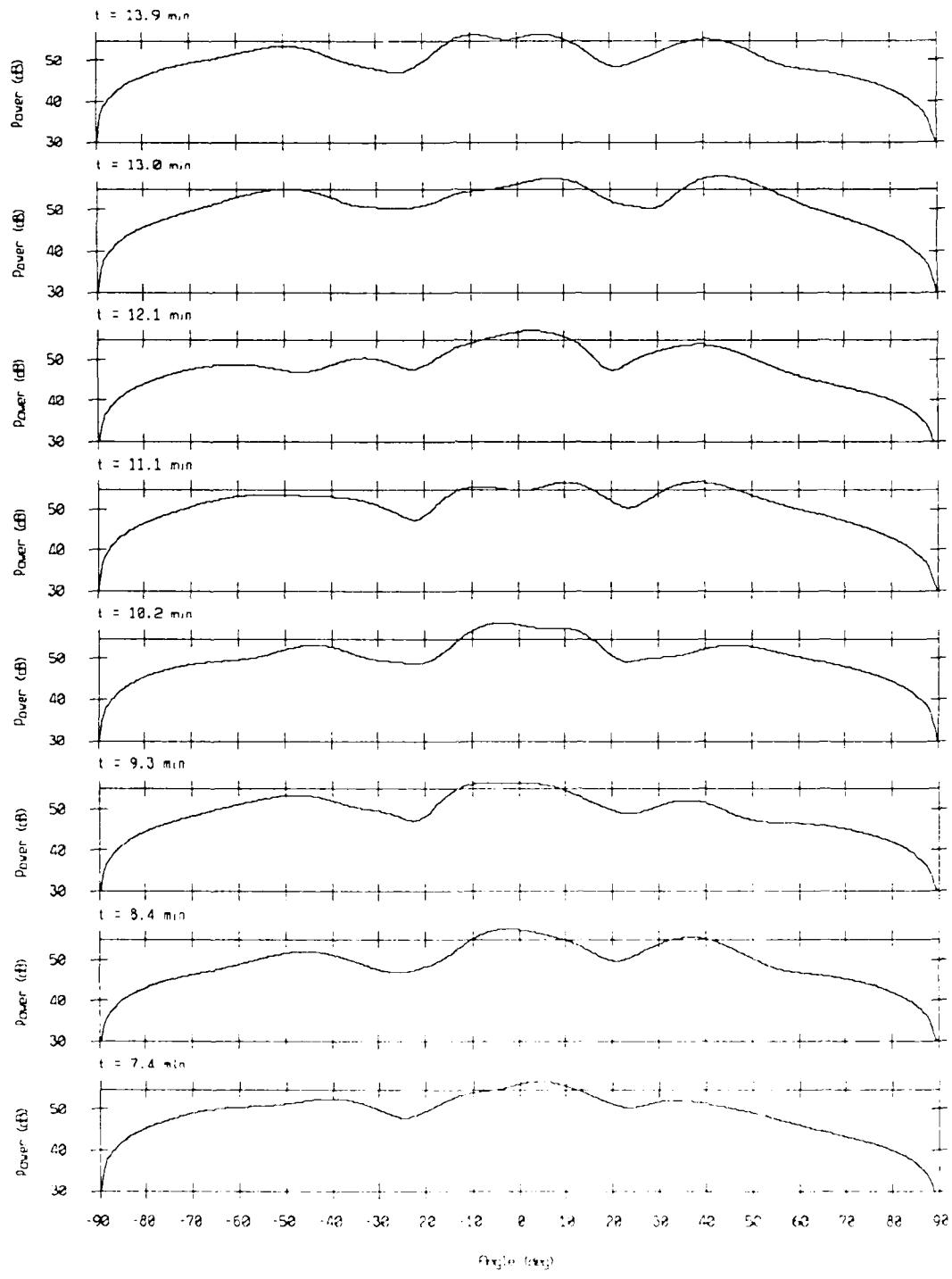
Array Response - 86060 Bin #4793

$f = 100$  Hz, KB window ( $\alpha$ ) $\phi = 1.5$ )

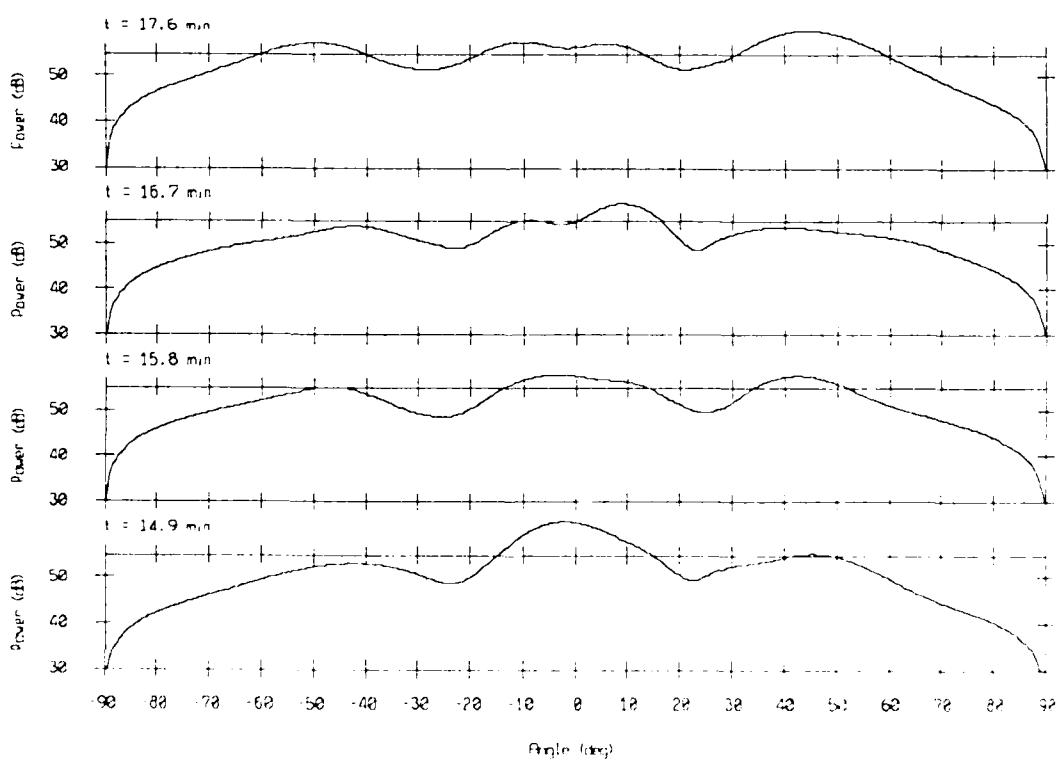


Array Response - 86060 Bin #4793

$f = 100$  Hz, KB window ( $\alpha = 1.5$ )

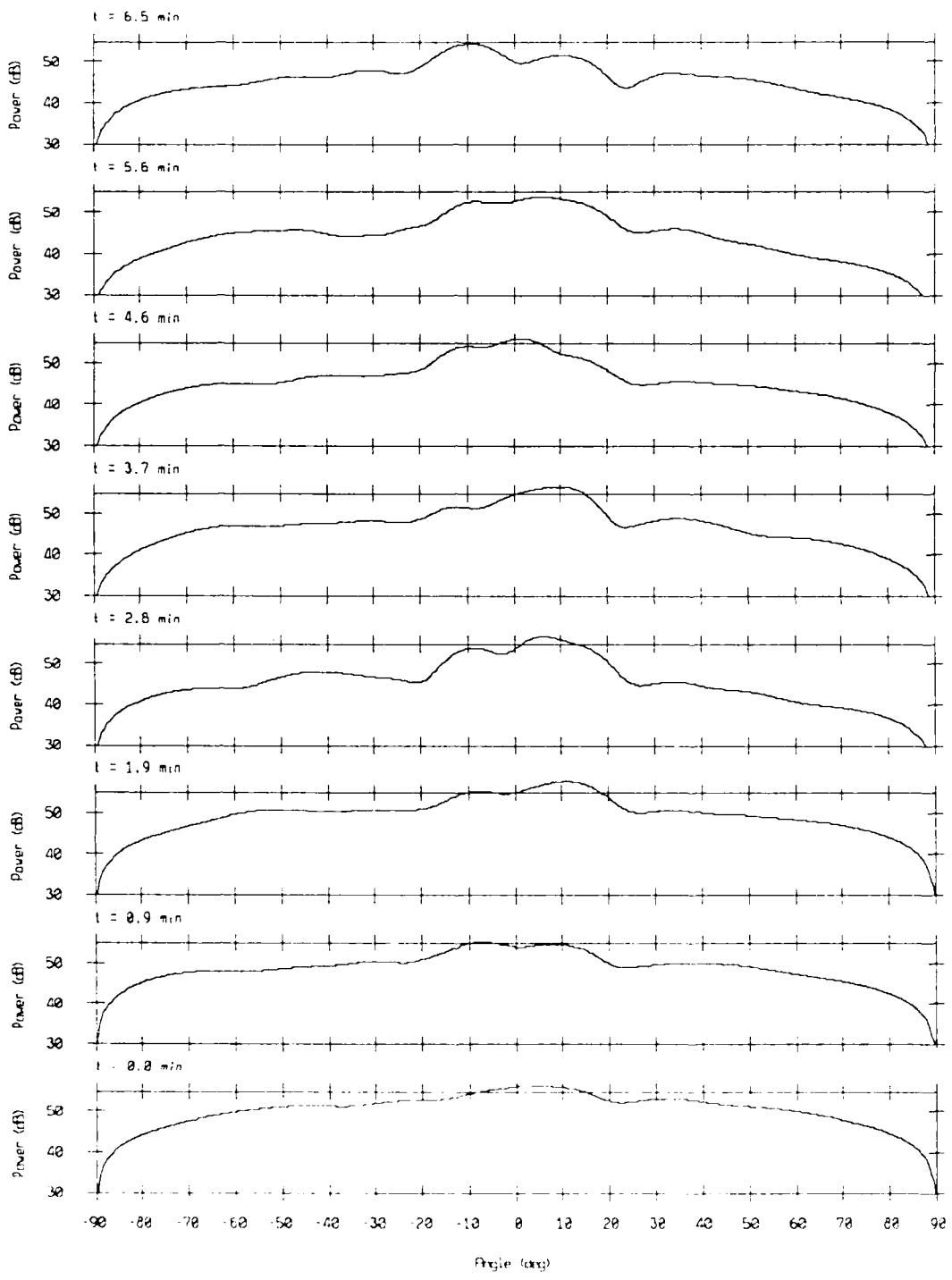


Array Response - 86060 Bin #4793  
 $f = 100$  Hz, KB window ( $\alpha$ lpha = 1.5)



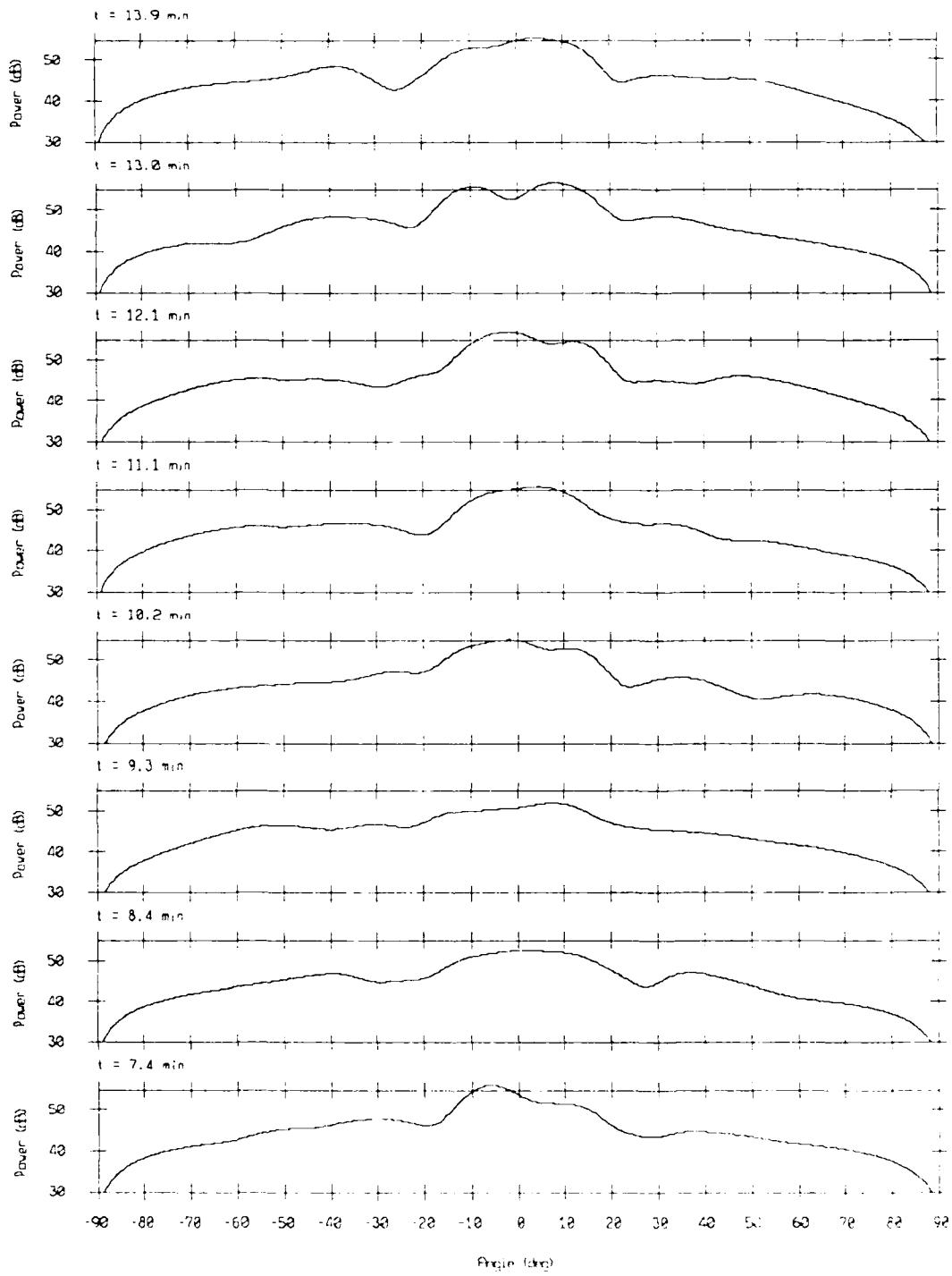
Array Response - 86060 Bin #4967

$f = 125$  Hz, KB window ( $\alpha$ pha = 1.5)

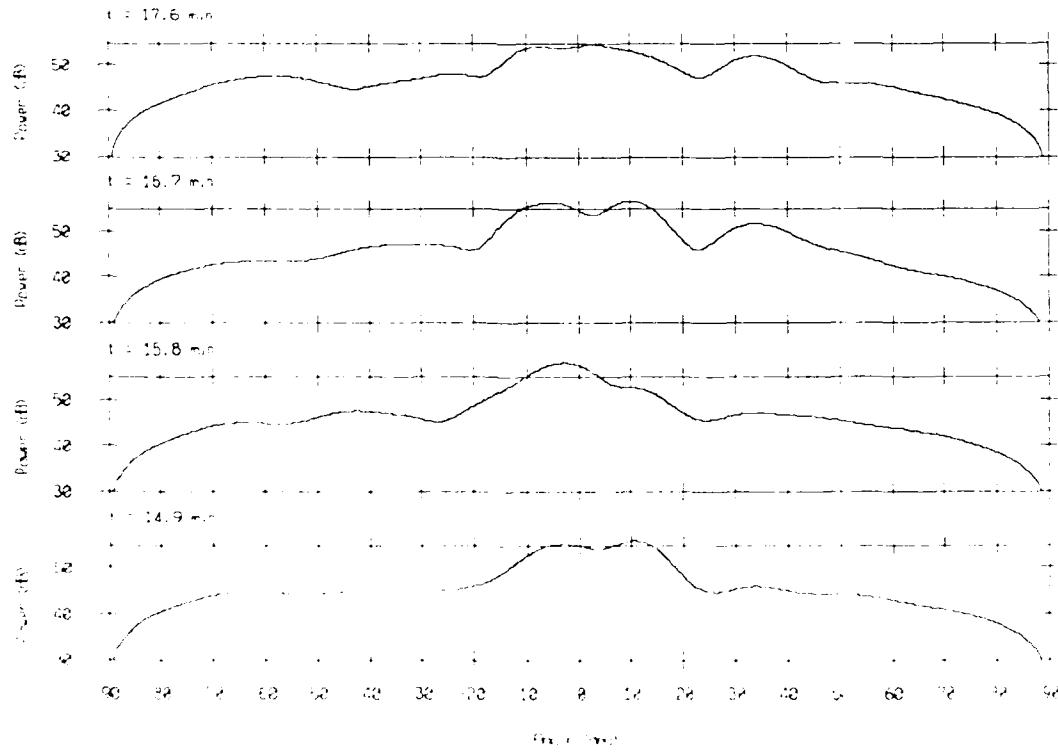


Array Response - 86262 Bin #4967

$f = 125$  Hz, K3 window ( $\alpha_{pro} = 1.5$ )

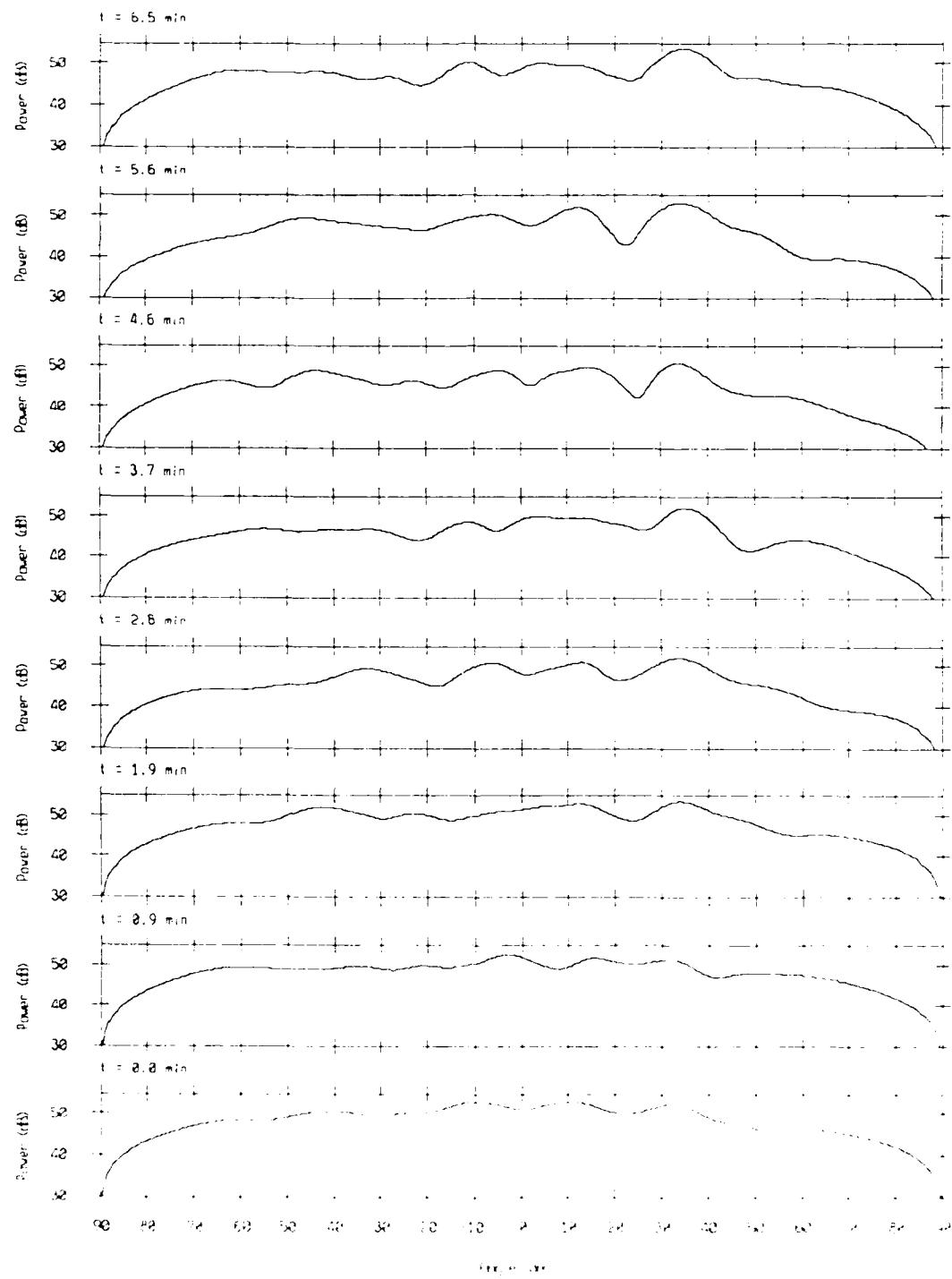


Array Response - 86250 Bin #4967  
 $f = 125$  Hz, KB window ( $\alpha$ pha = 1.5)



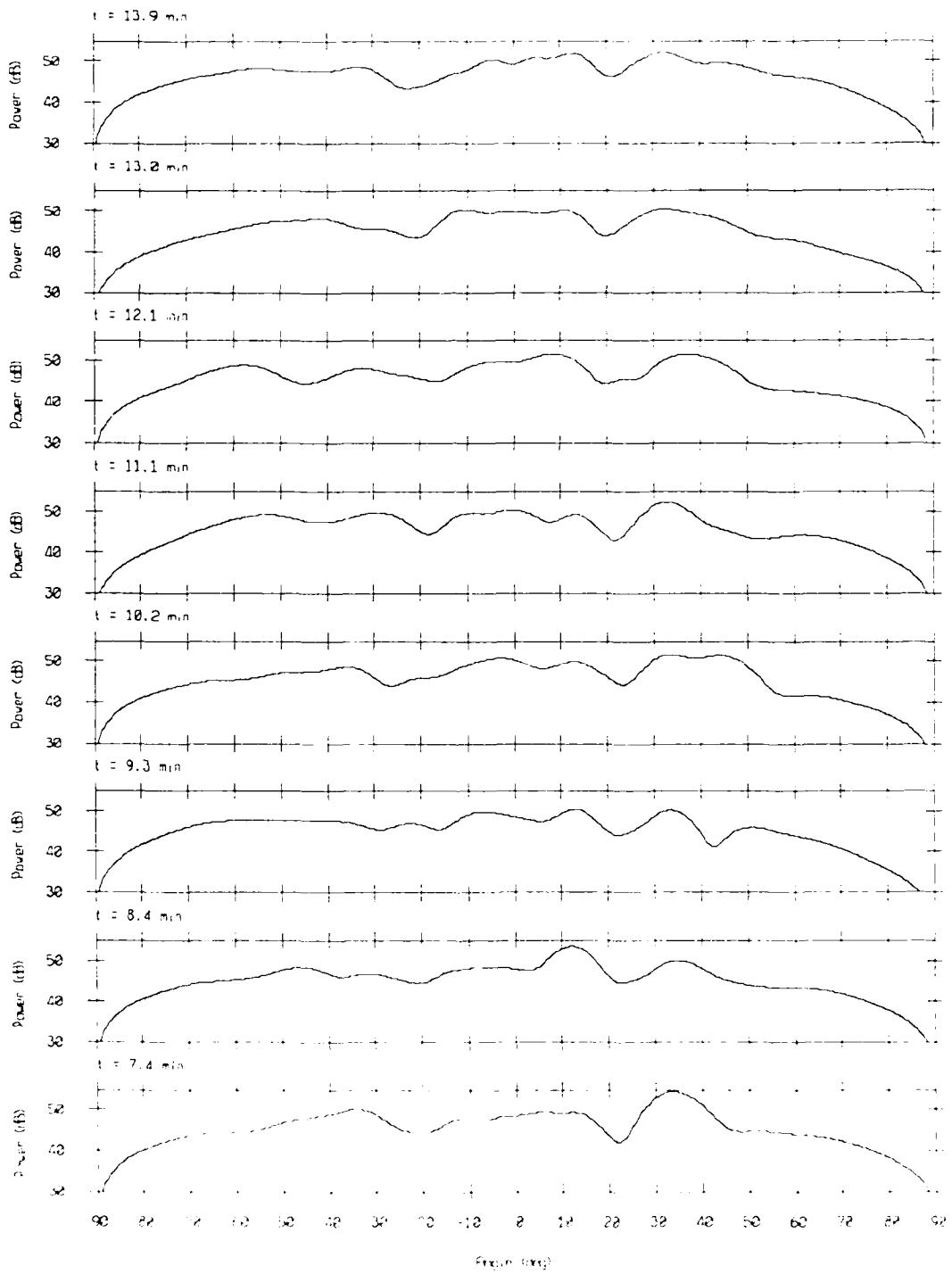
Array Response - 86062 Bin #5141

f = 150 Hz, K5 window (alpha = 1.5)

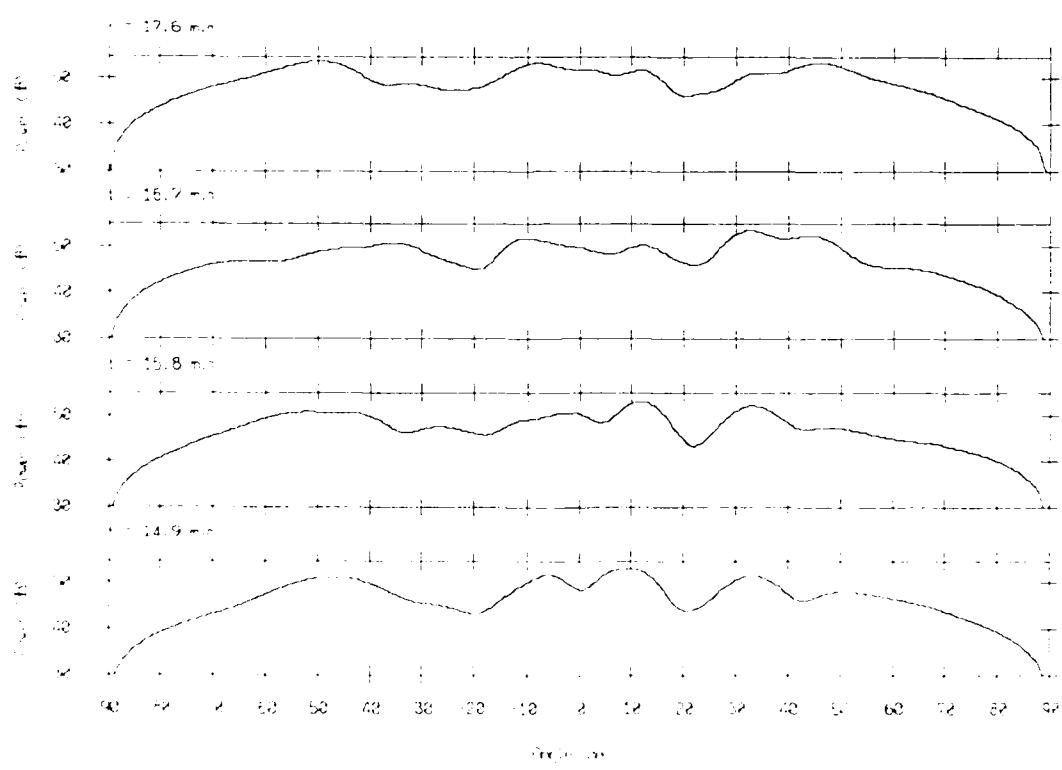


Array Response - 85862 Bin #5141

f = 150 Hz, K5 window (alpha = 1.5)

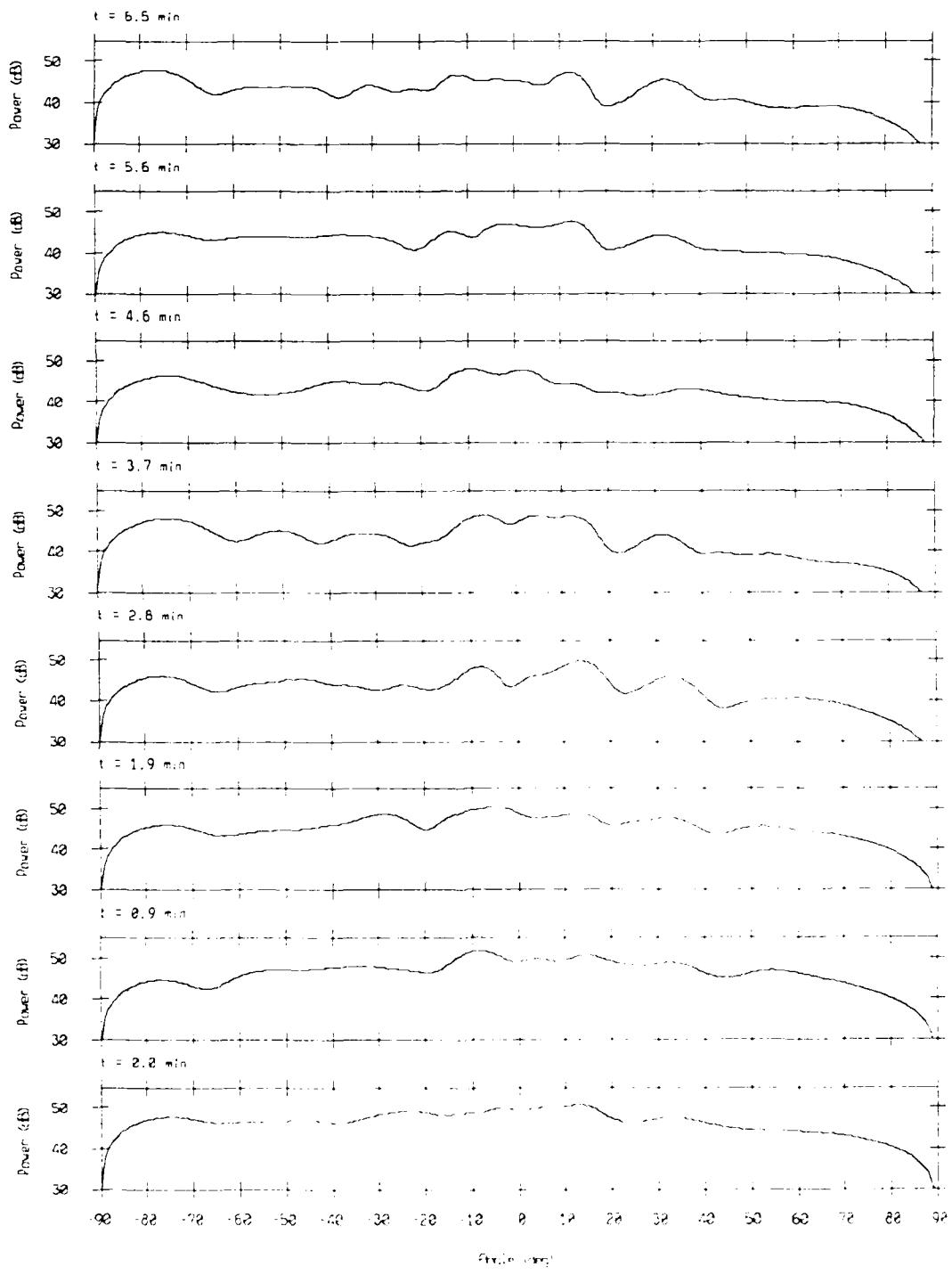


Finney Response - 86260 BH #6141  
 $f = 152$  Hz,  $\times 3$  window (slope = 1.5)



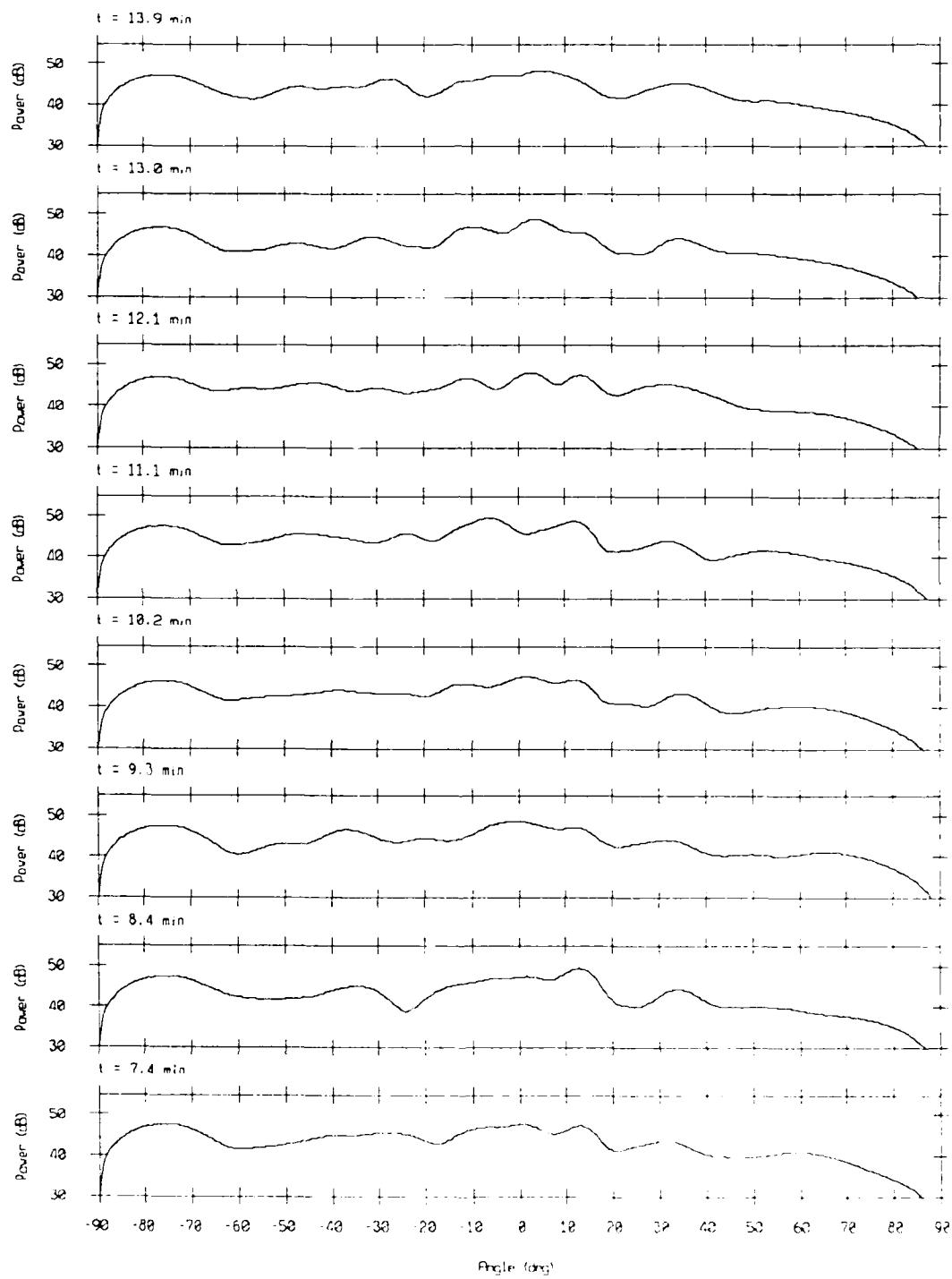
Array Response - 86260 Bin #5316

$f = 175$  Hz, KB window ( $\alpha$ lpha = 1.5)

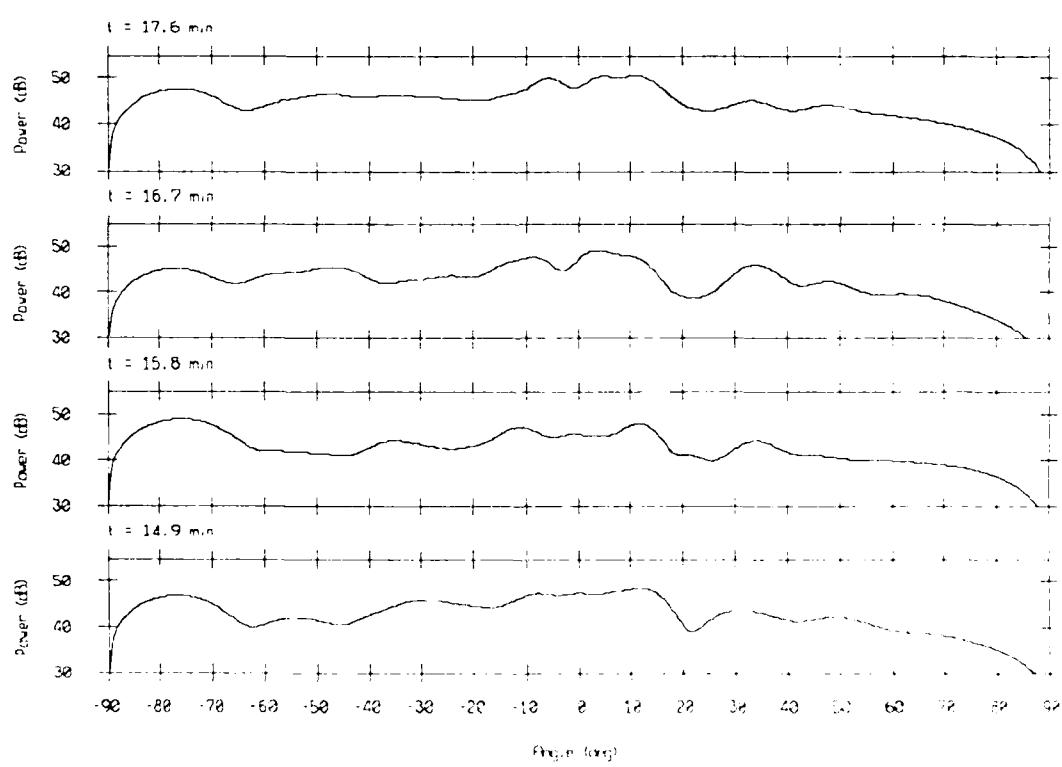


Array Response - 85060 Bin #5316

$f = 175$  Hz, KB window ( $\alpha = 1.5$ )

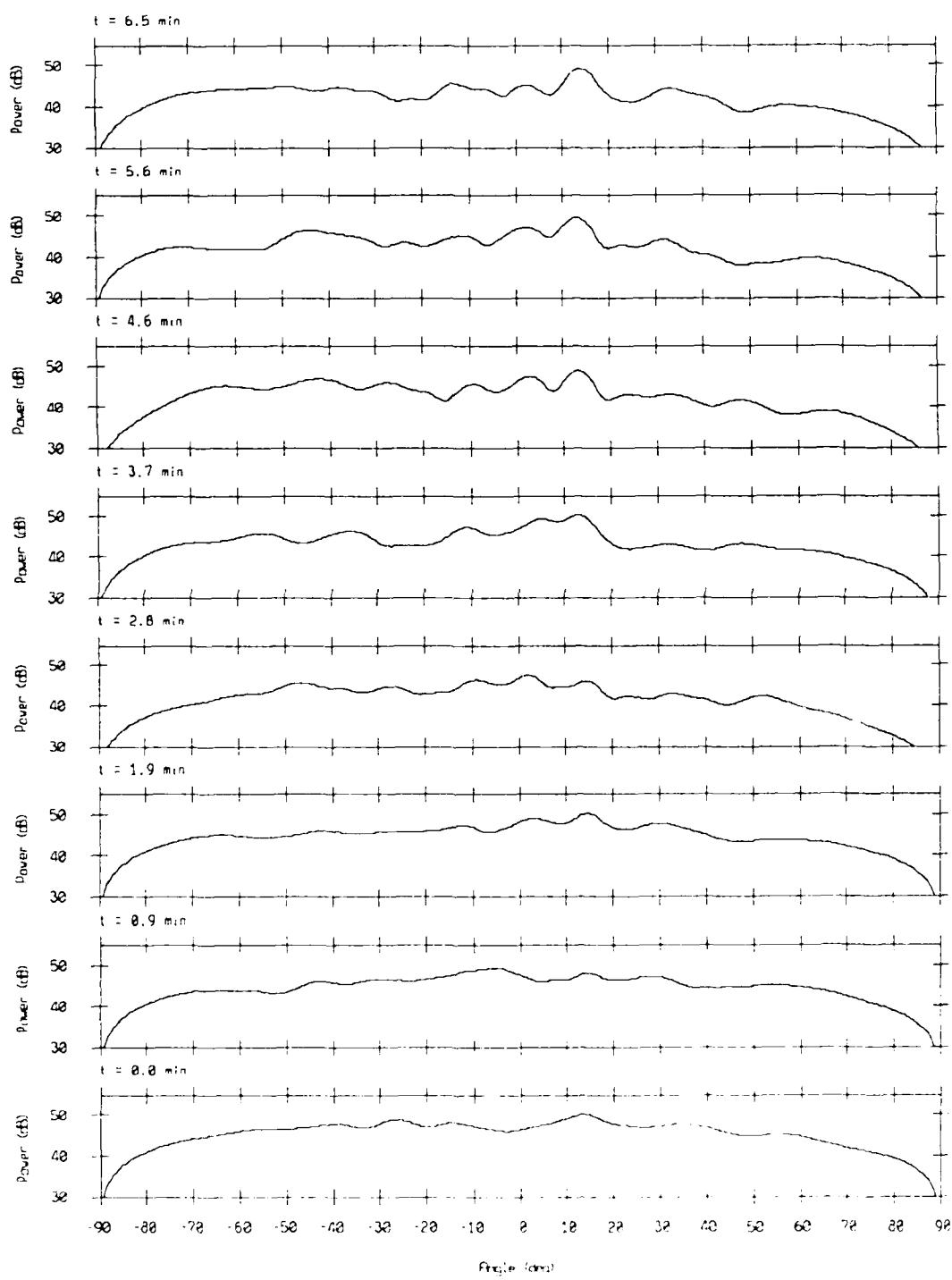


Array Response - 86060 Bin #5316  
 $f = 175$  Hz, KB window ( $\alpha$ lpha = 1.5)



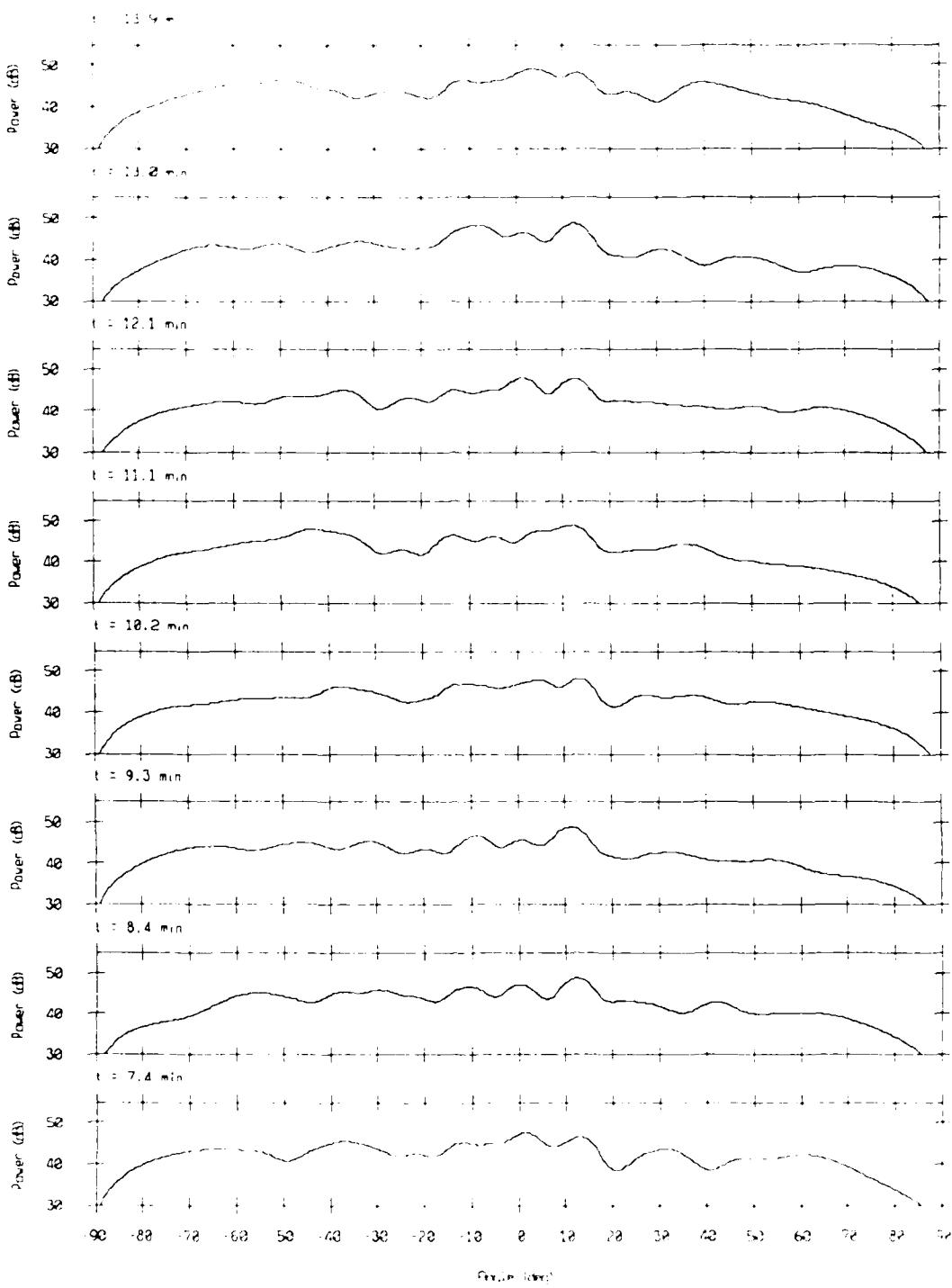
Array Response - 86060 Bin #5490

$f = 200$  Hz, KB window ( $\alpha$ lpha = 1.5)



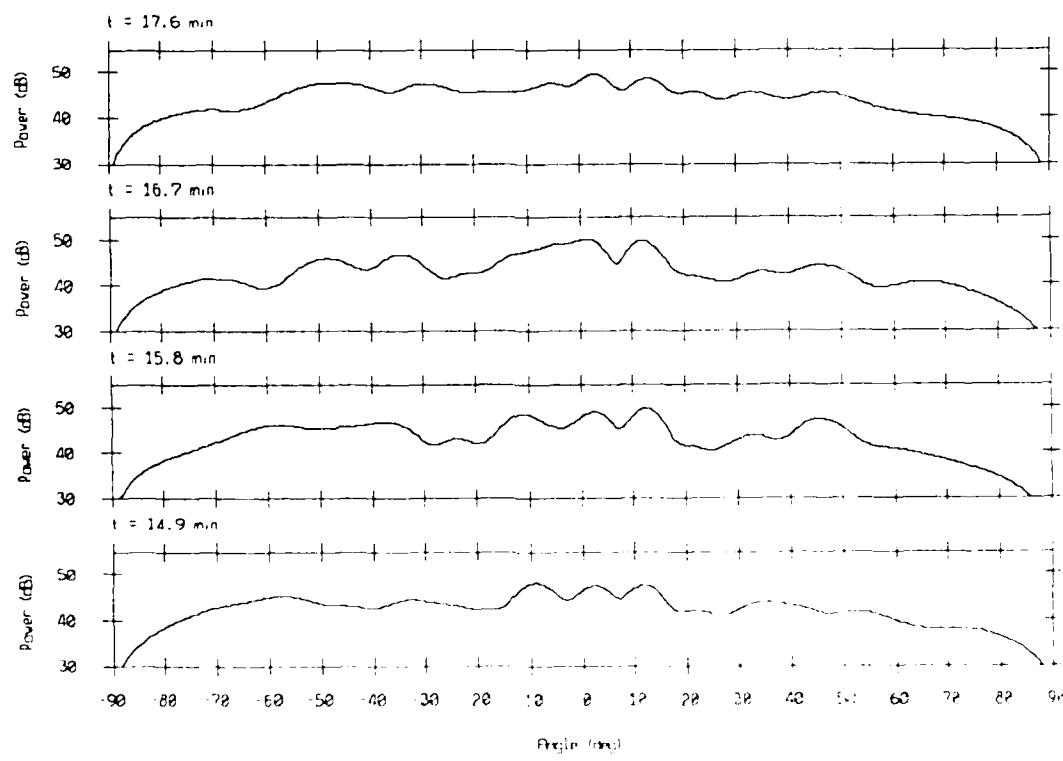
Pring, Rutherford 86068 B1-#5492

$f = 220$  Hz, 65 winds (line = 1.5)



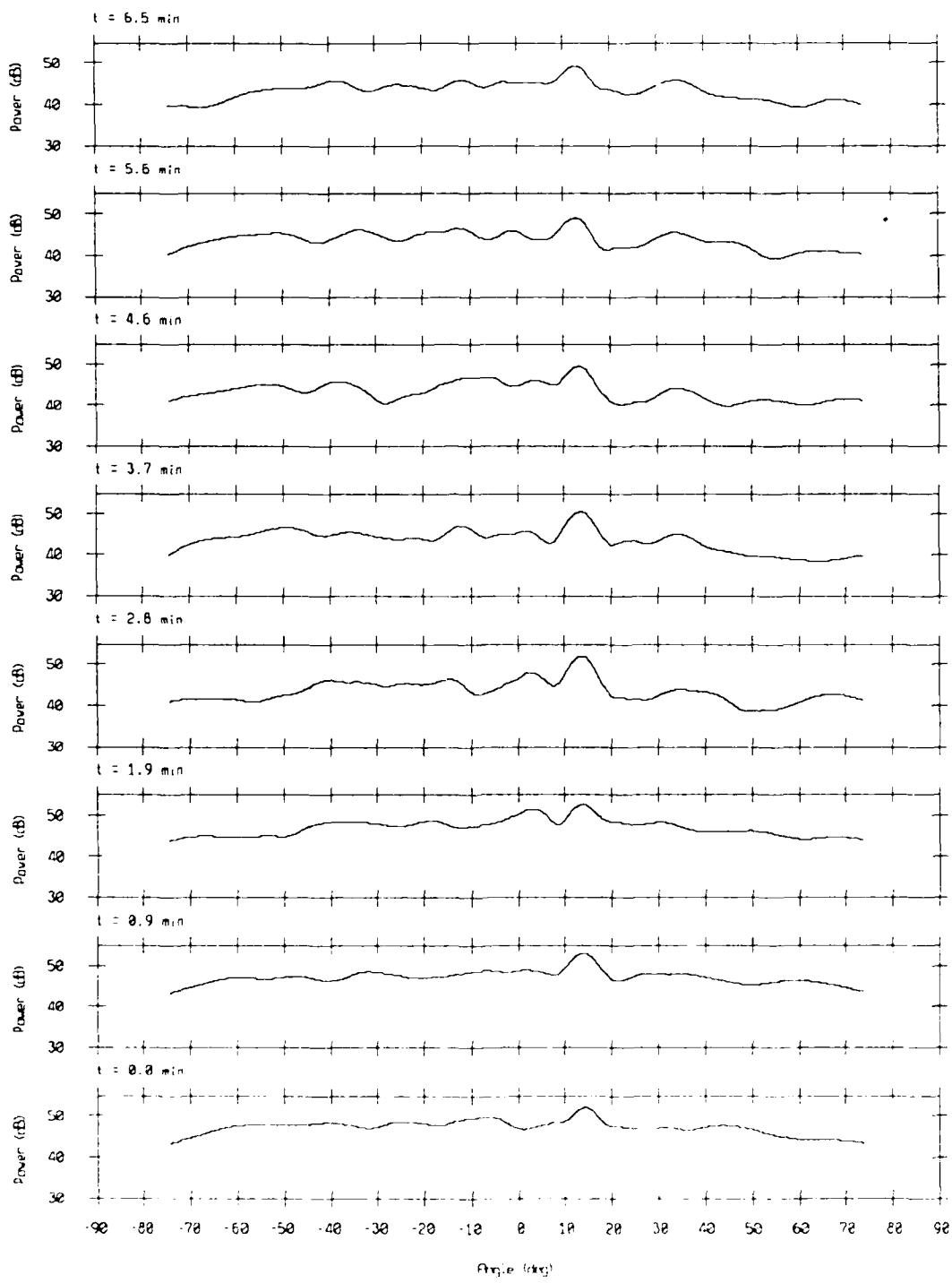
Array Response - 86062 Bin #5490

f = 200 Hz, KB window (alpha = 1.5)

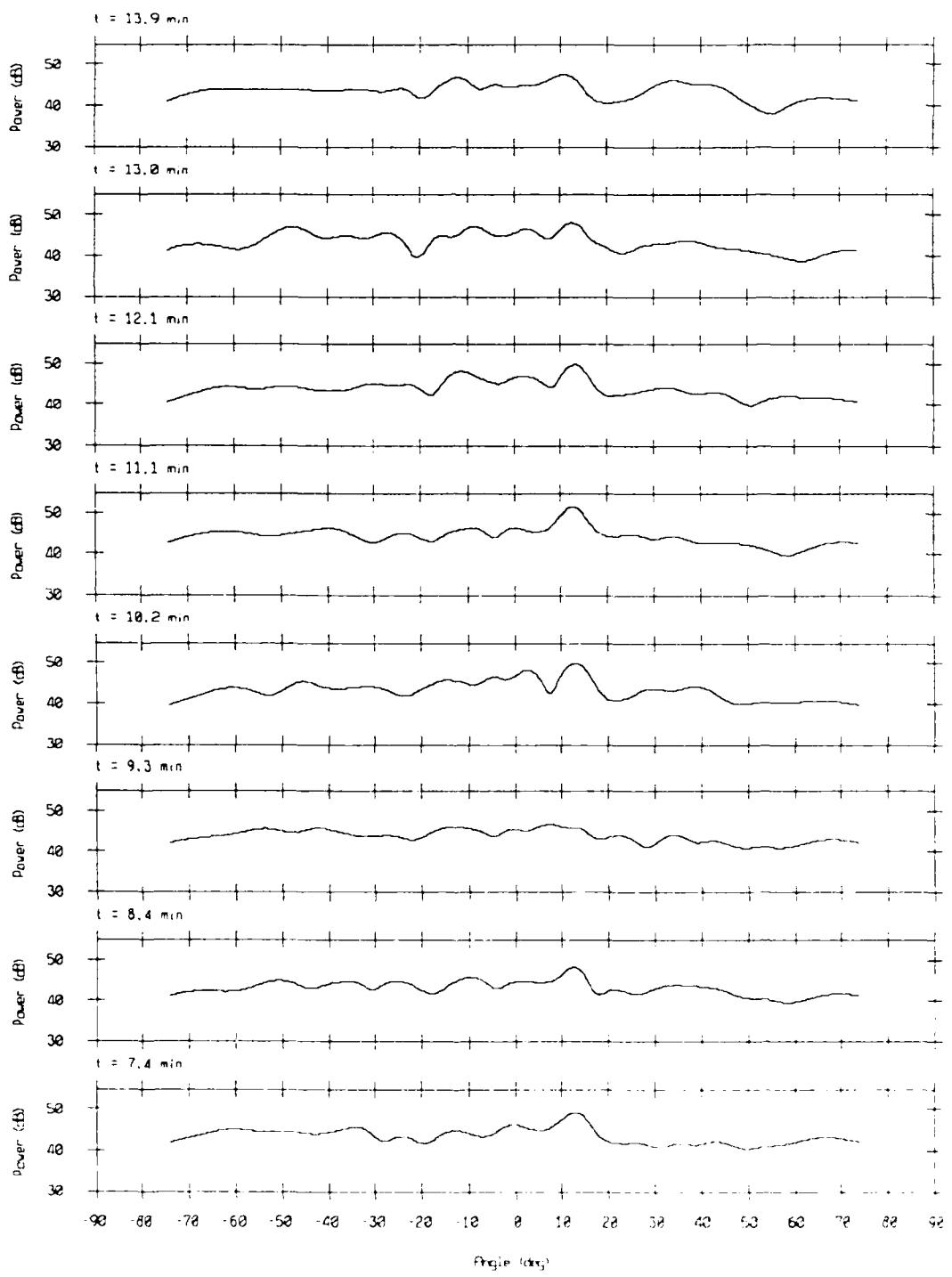


Array Response - 86060 Bin #5664

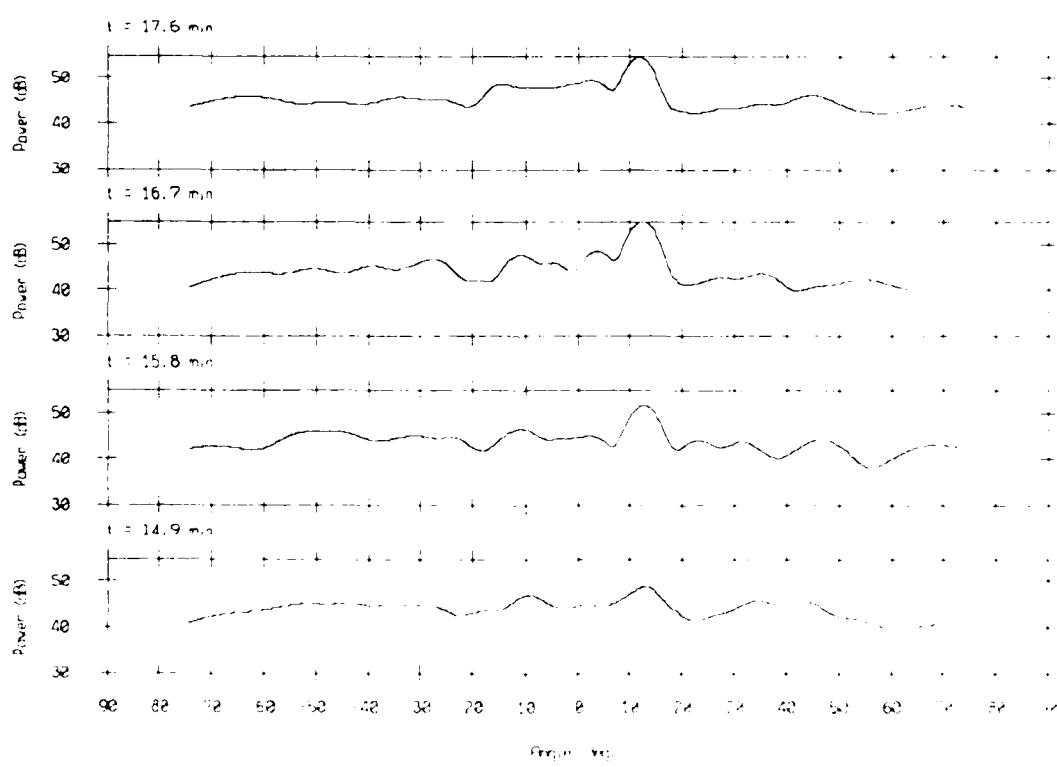
$f = 225$  Hz, KB window ( $\alpha = 1.5$ )



Array Response - 86260 Bin #5664  
 $f = 225$  Hz, KB window ( $\alpha$  = 1.5)

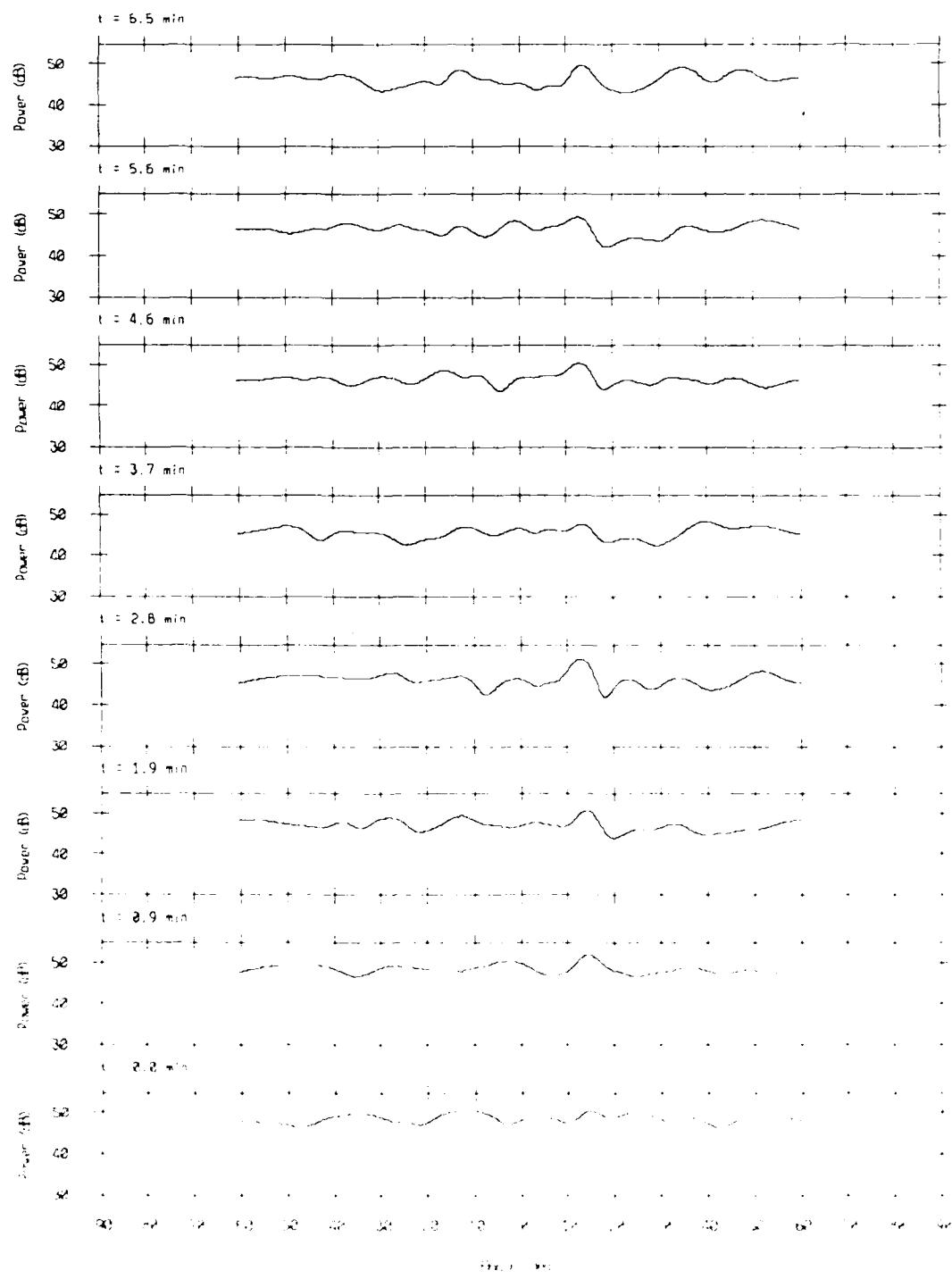


Array Response - 85060 Bin #5664  
 $f = 225$  Hz, KB window ( $\alpha = 1.5$ )



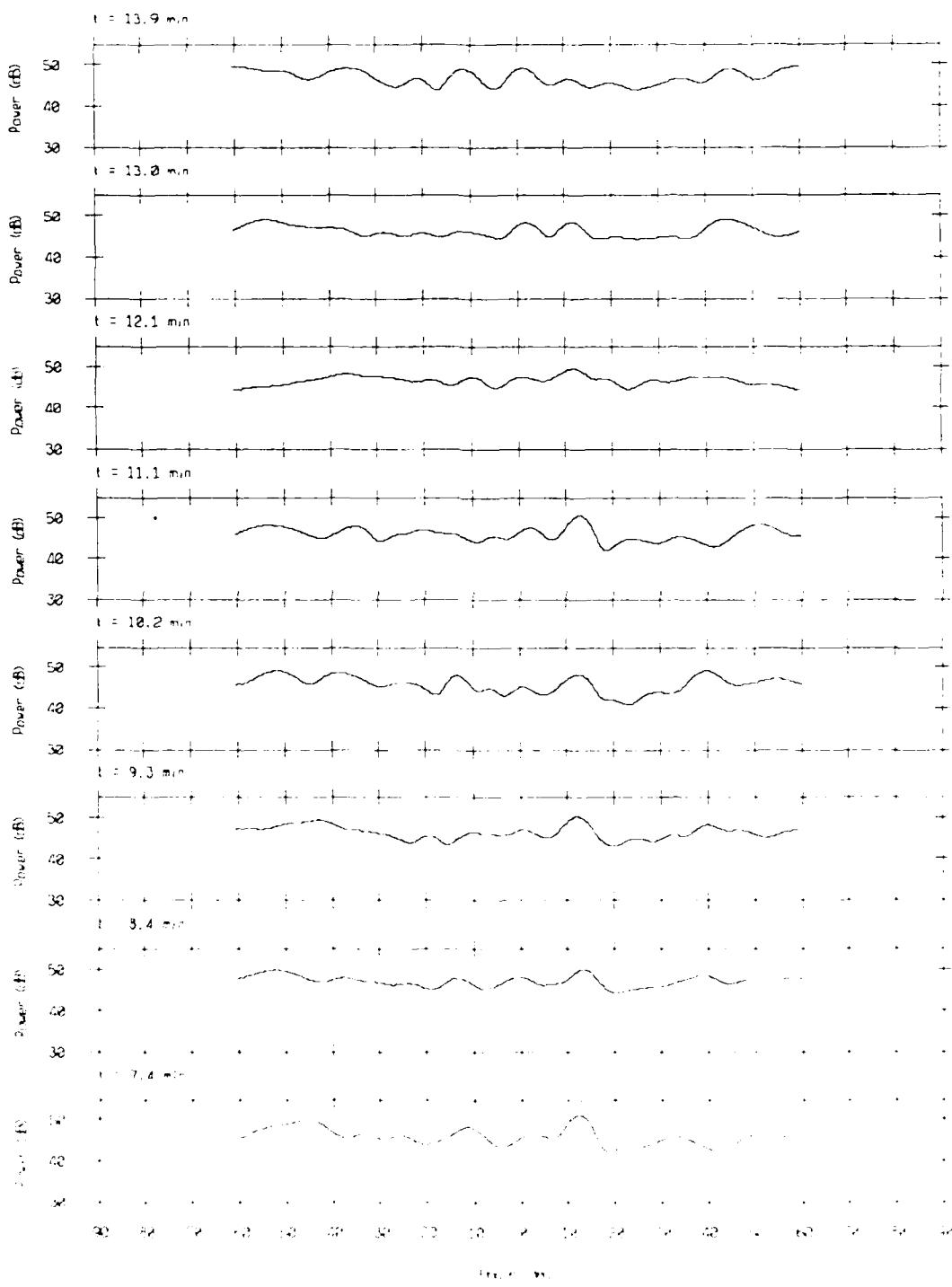
Array Response - 86060 Bin #5832

f = 250 Hz, KB window (alpha = 1.5)

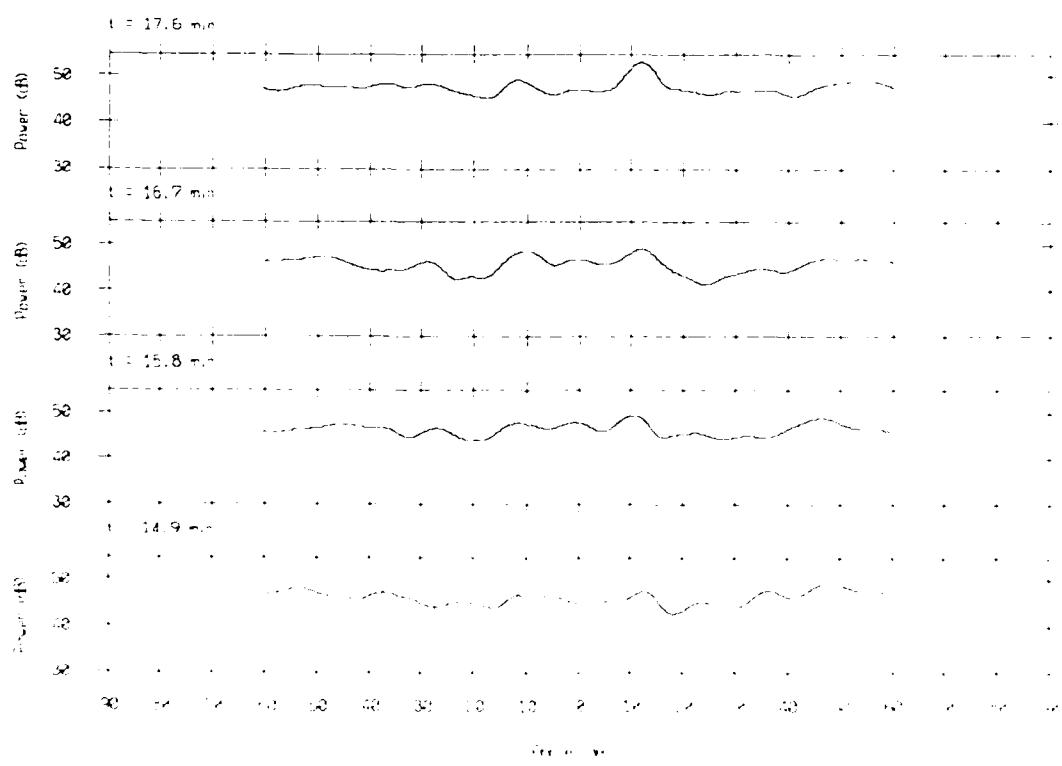


Array Response - 86060 Bin #5832

$f = 250$  Hz, KB window ( $\alpha_{\text{pre}} = 1.5$ )

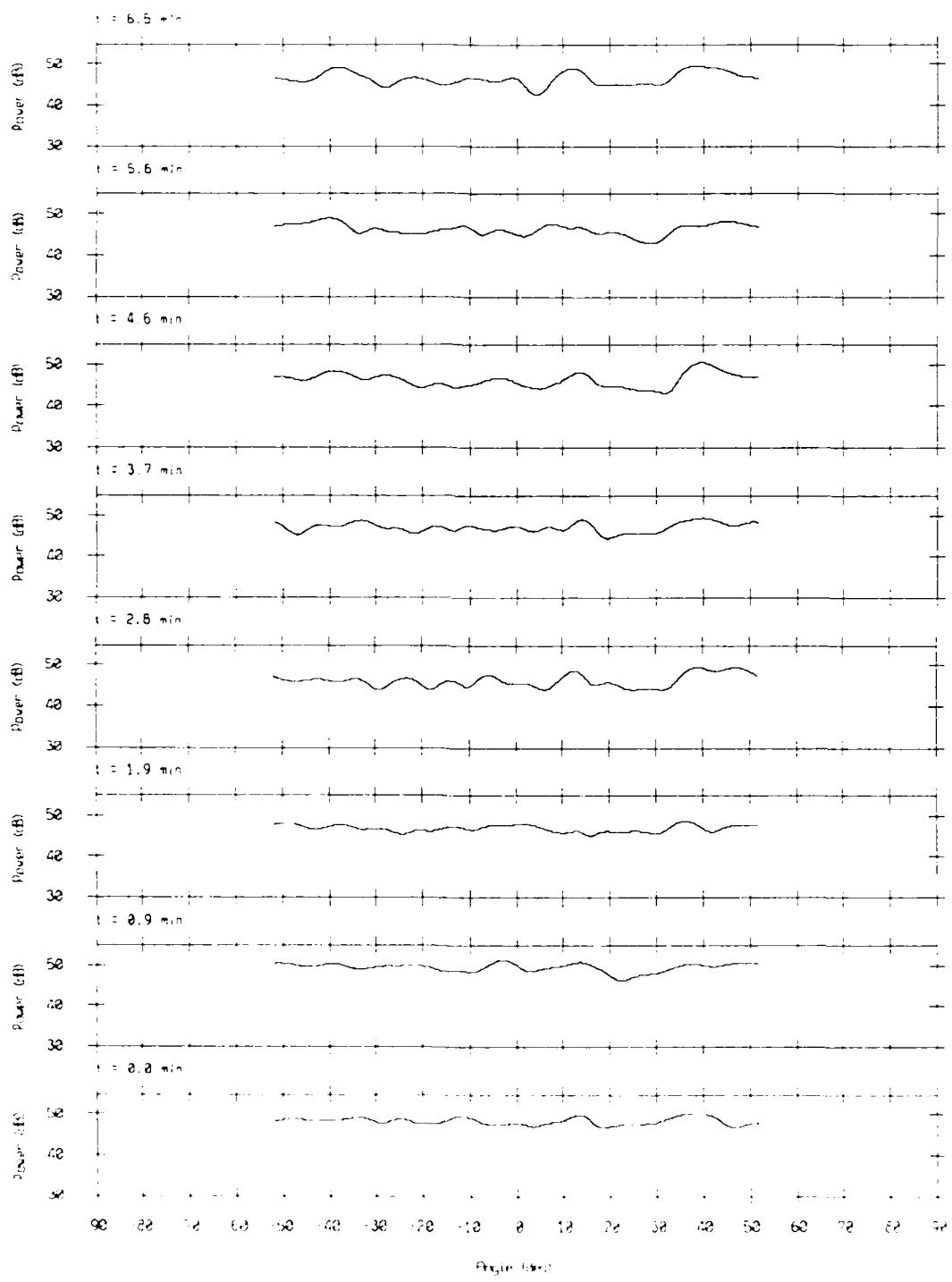


Array Response = 86062 Bin #5832  
f = 250 Hz, K3 window (alpha = 1.5)



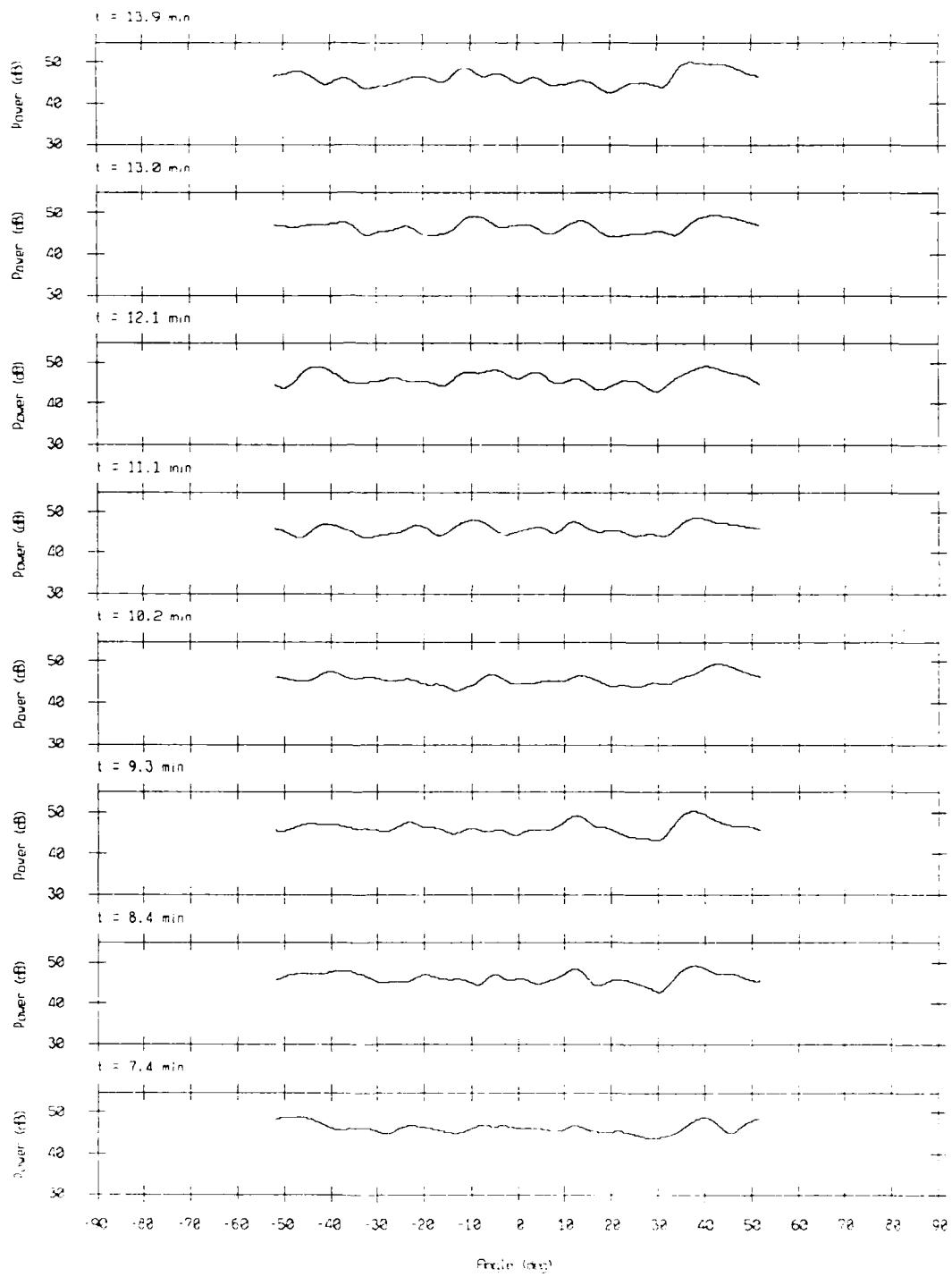
Array Response - 86260 Bin #6212

$f = 275$  Hz, K5 window (cycles = 1.5)



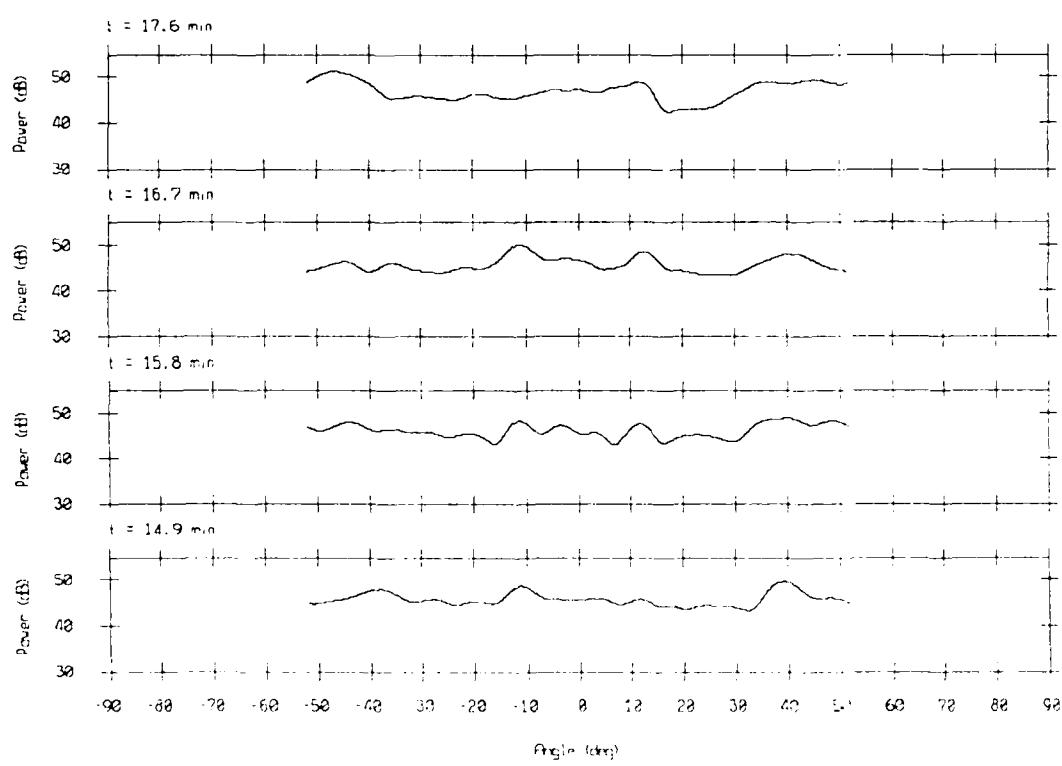
Array Response - 86262 Bir #6012

$f = 275$  Hz, KB window ( $\alpha = 1.5$ )



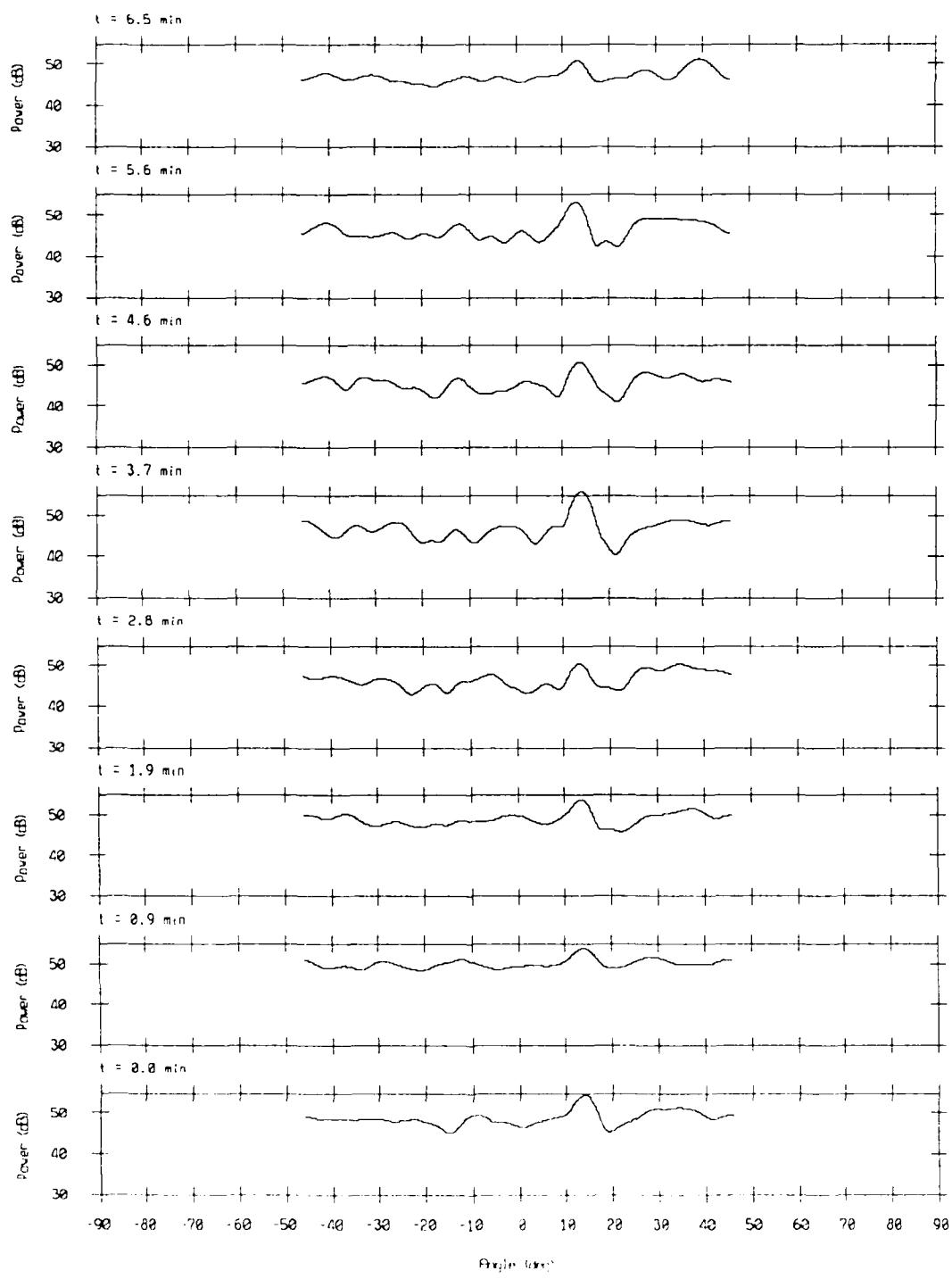
Array Response - 86060 Bin #6012

f = 275 Hz, KB window (alpha = 1.5)



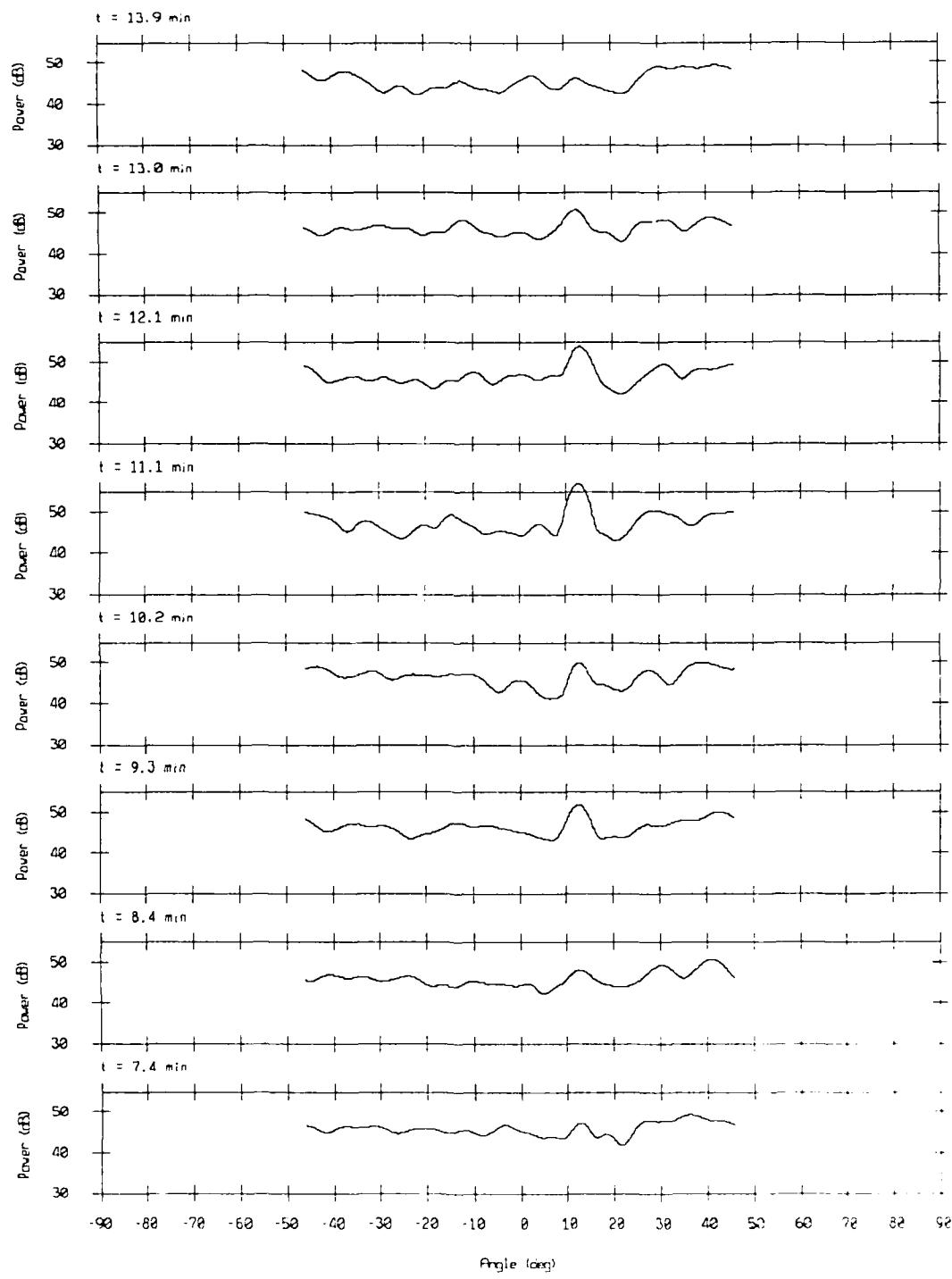
Array Response - 86060 Bin #6186

$f = 300$  Hz, KB window ( $\alpha$  = 1.5)



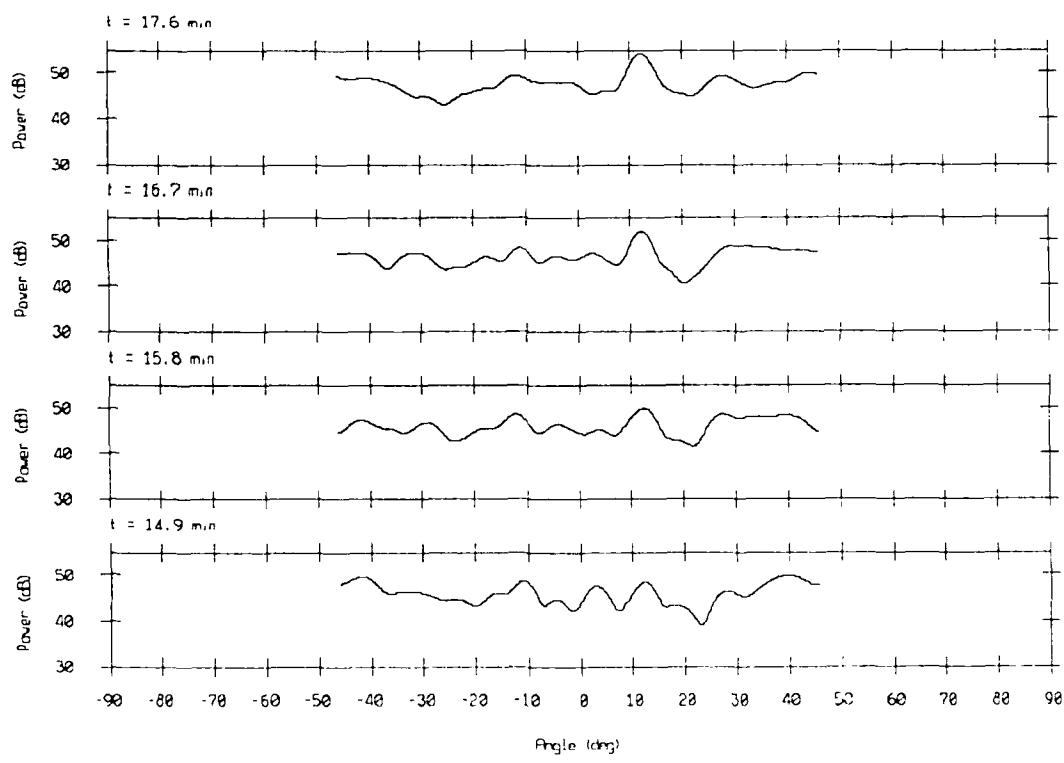
Array Response - 86060 Bin #6186

$f = 300$  Hz, KB window ( $\alpha = 1.5$ )



Array Response - 86060 Bin #6186

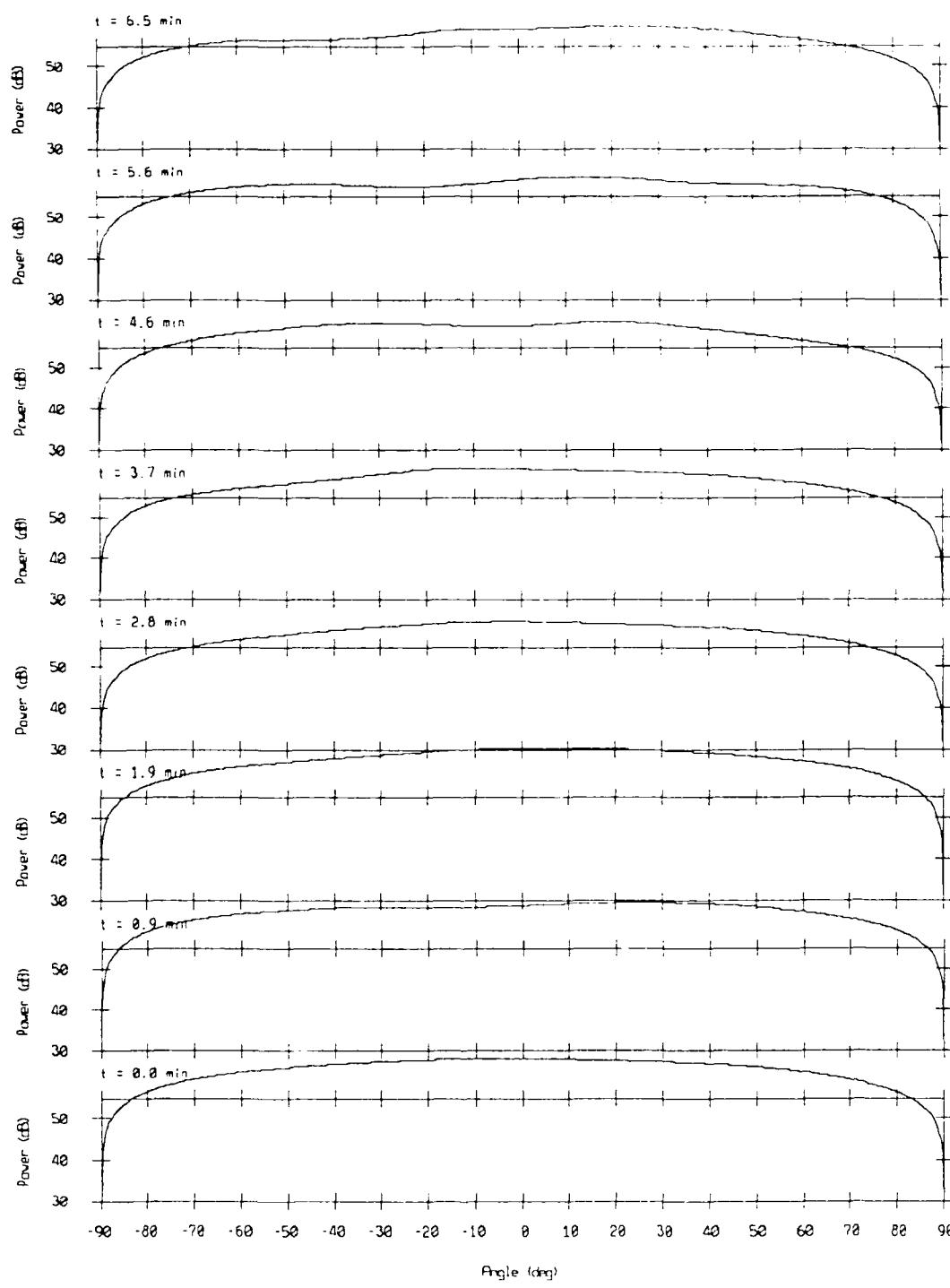
f = 300 Hz, KB window ( $\alpha$  = 1.5)



**VII. Array Response: Panels, Rect Window.**

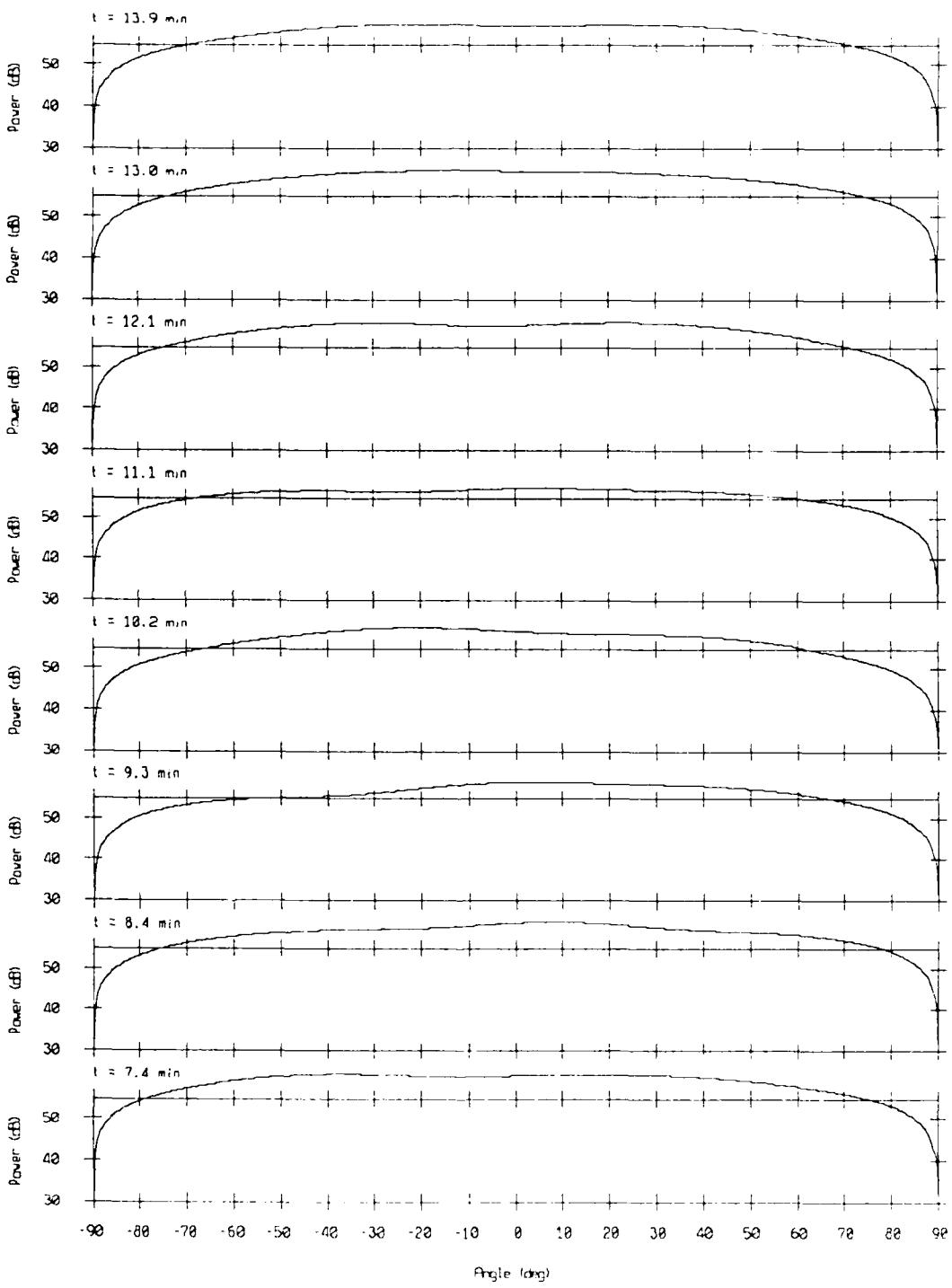
Array Response - 86060 Bin #4271

$f = 25$  Hz, rect window



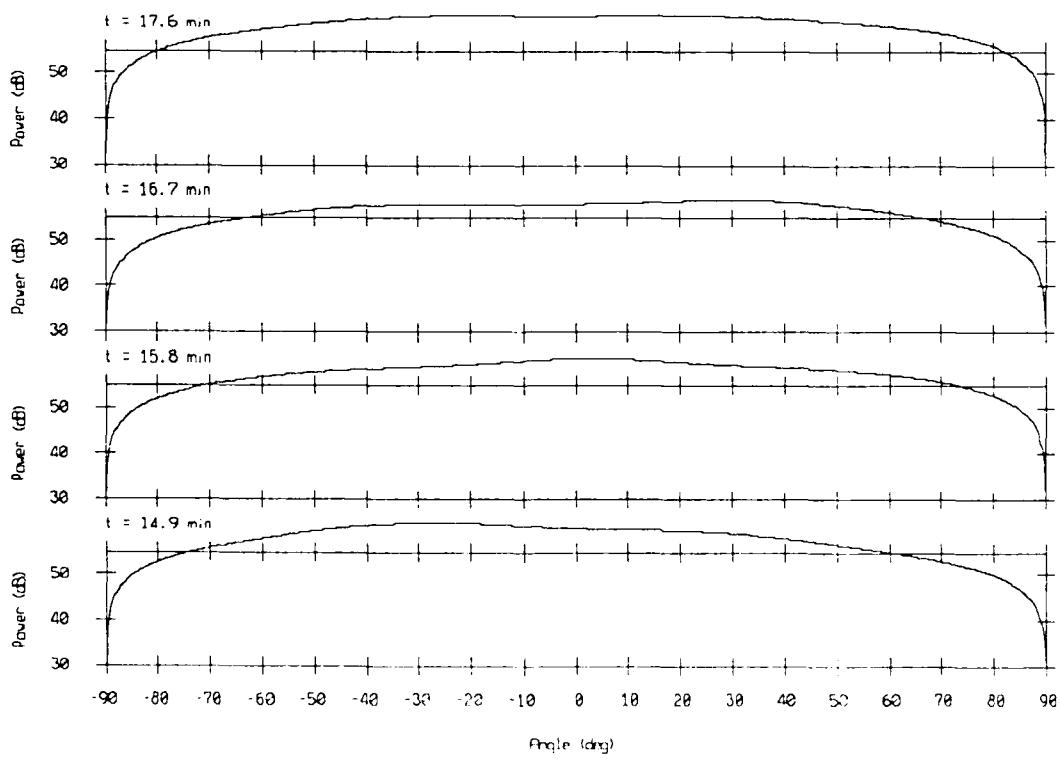
Array Response - 86060 Bin #4271

$f = 25$  Hz, rect window



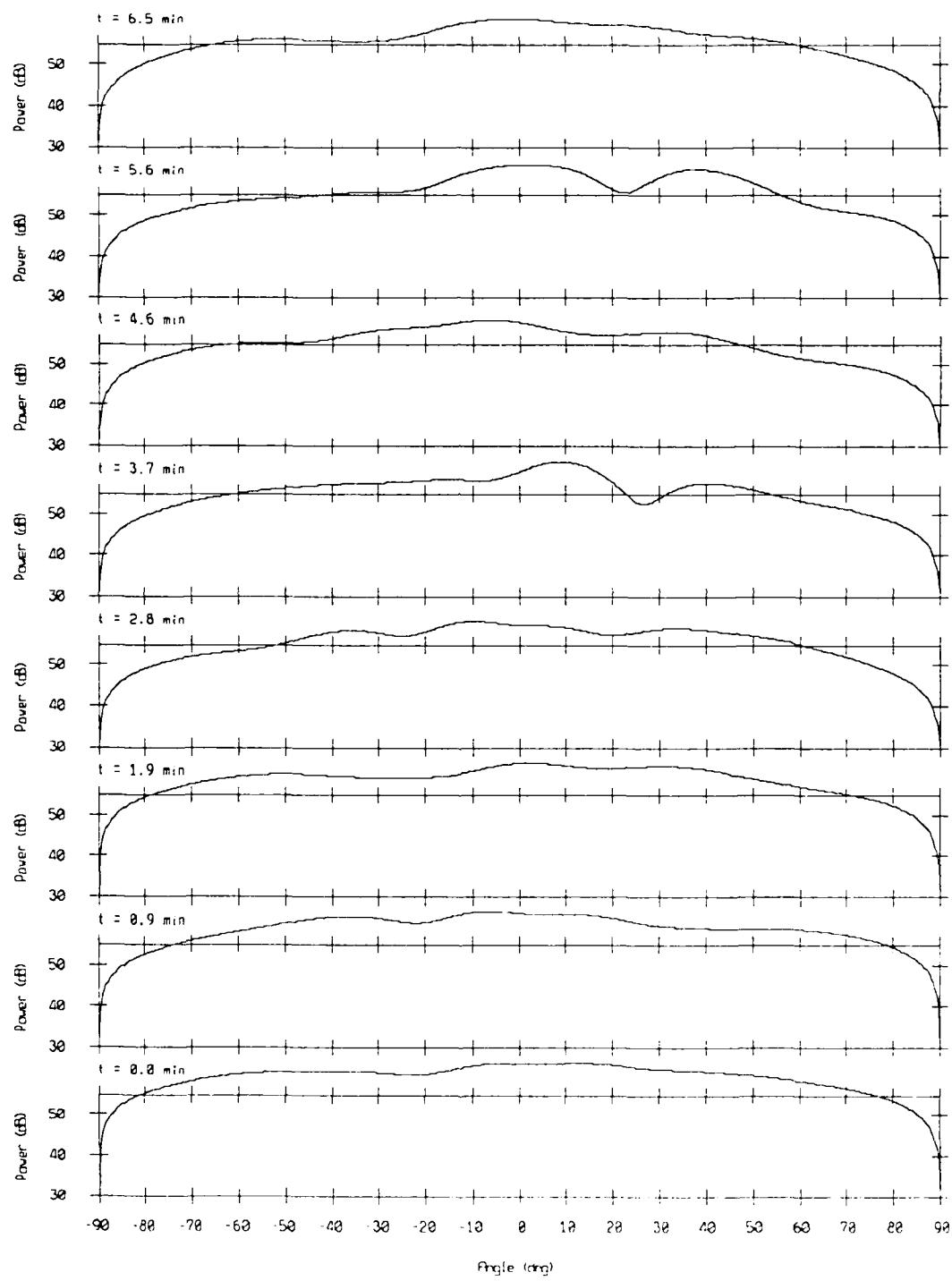
Array Response - 86060 Bin #4271

f = 25 Hz, rect window



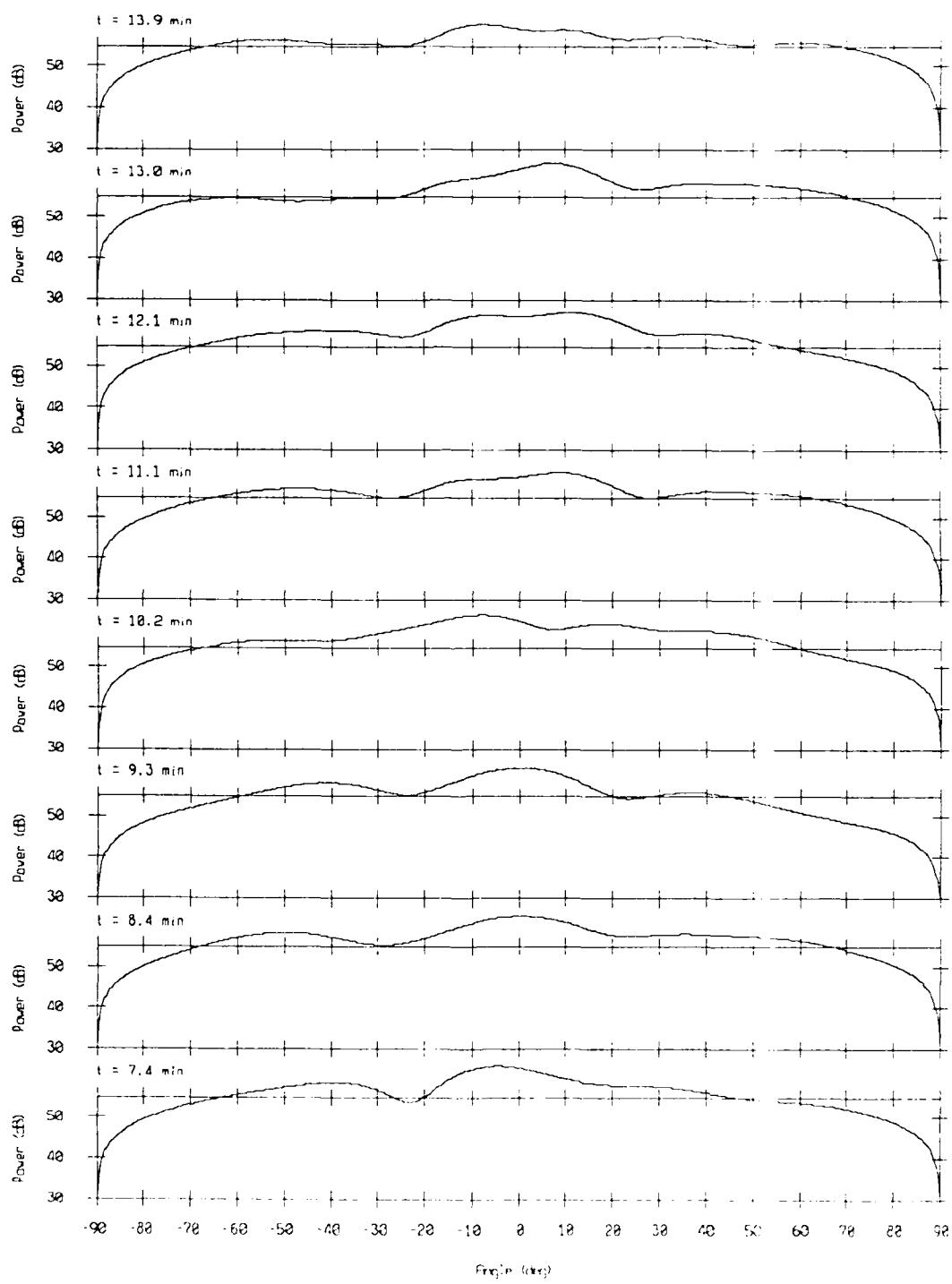
Array Response - 86060 Bin #4445

$f = 50$  Hz, rect window



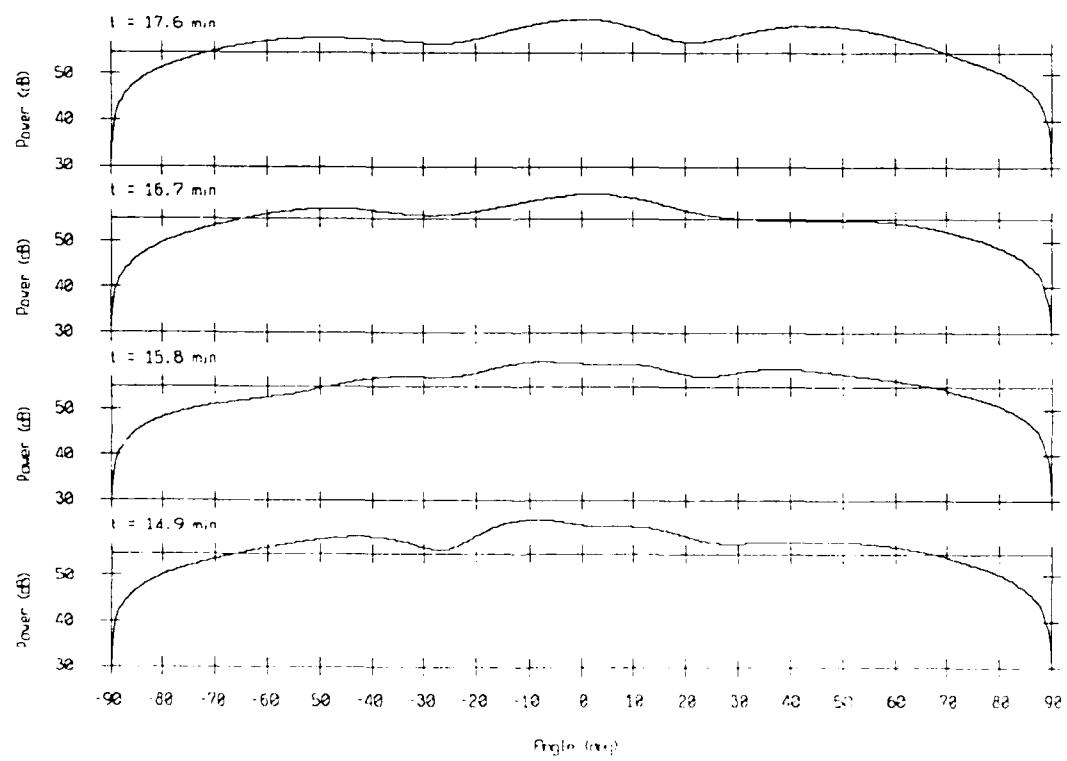
Array Response - 86060 Bin #4445

f = 50 Hz, rect window



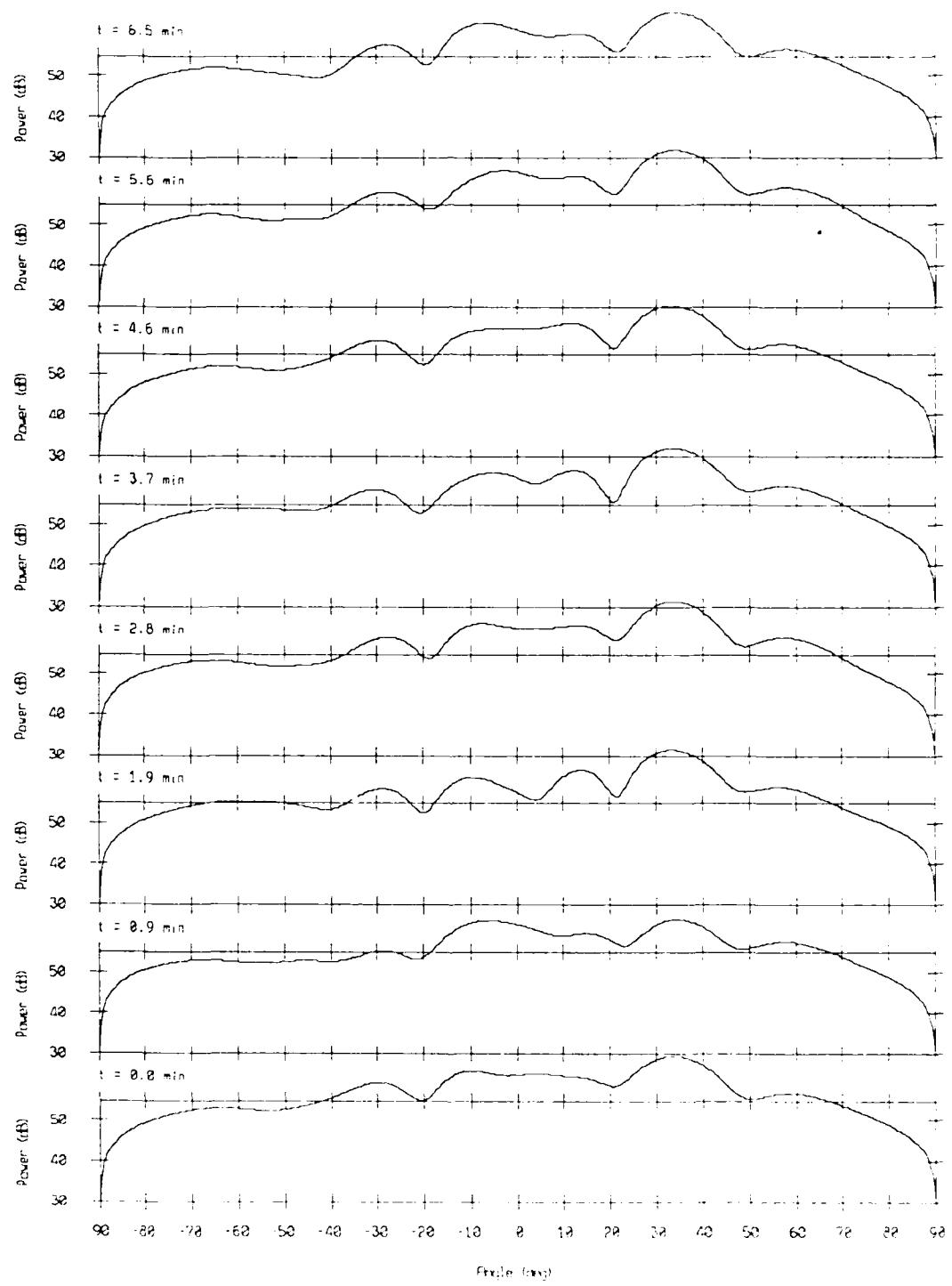
Array Response - 86060 Bin #4445

f = 50 Hz, rect window



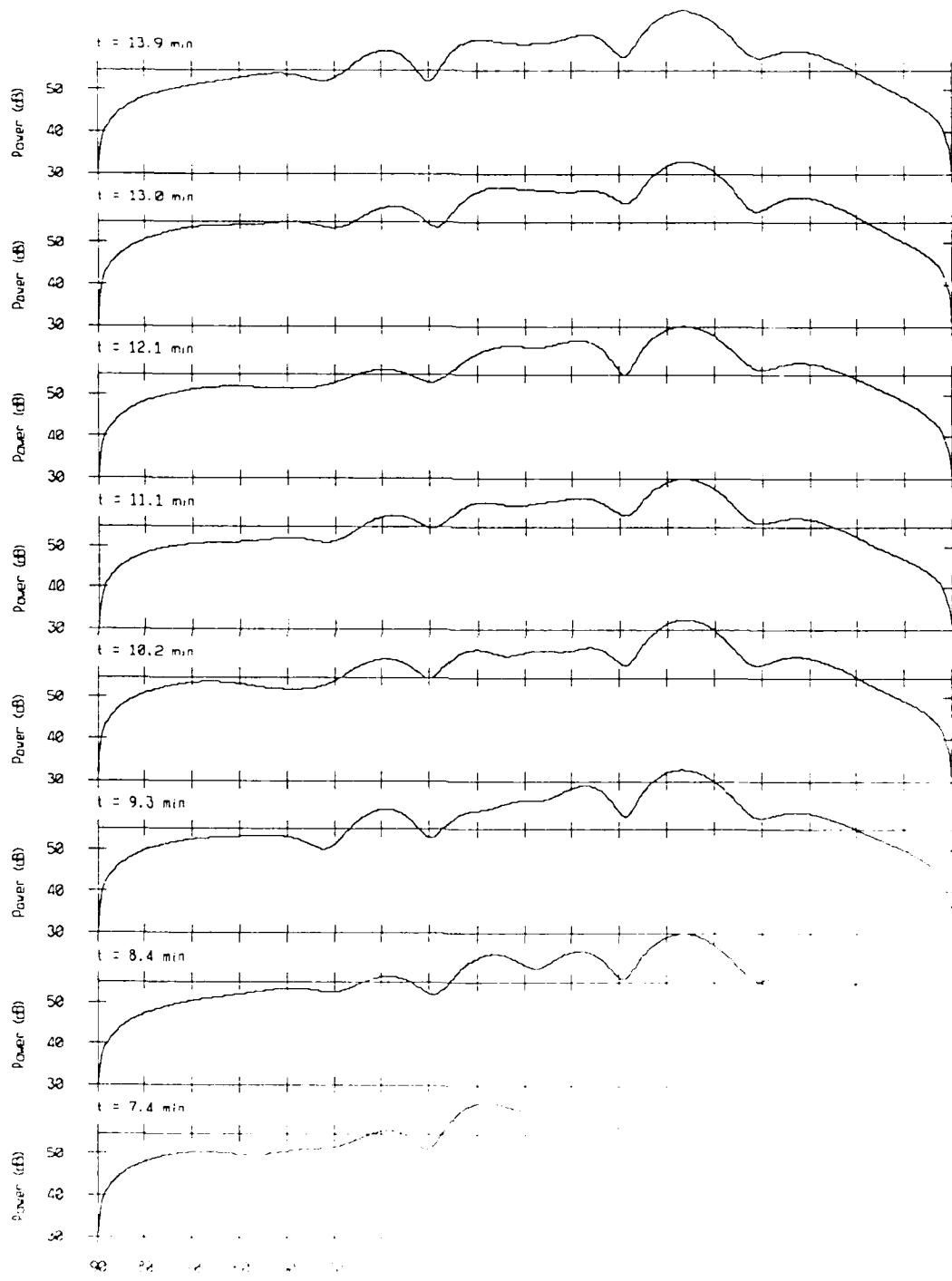
Array Response - 86260 Bin #4619

$f = 75$  Hz, rect window



Frney Response - 86060 Bin #4619

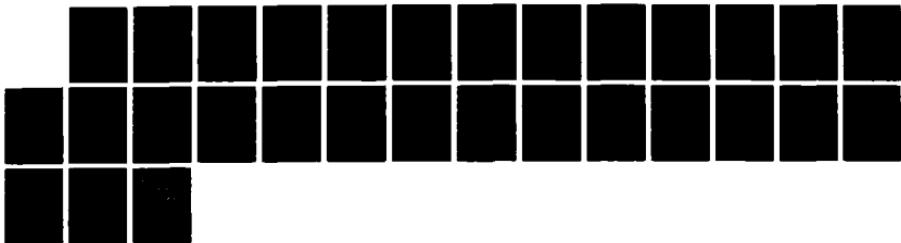
$f = 75$  Hz, rect window

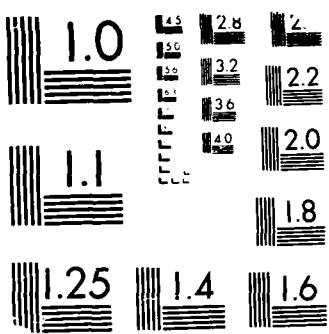


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VERTICAL DIRECTIONALITY OF AMBIENT NOISE AT 32 DEG N AS 2/2  
A FUNCTION OF LON. (U) SCRIPPS INSTITUTION OF  
OCEANOGRAPHY LA JOLLA CA MARINE PHYSIC.

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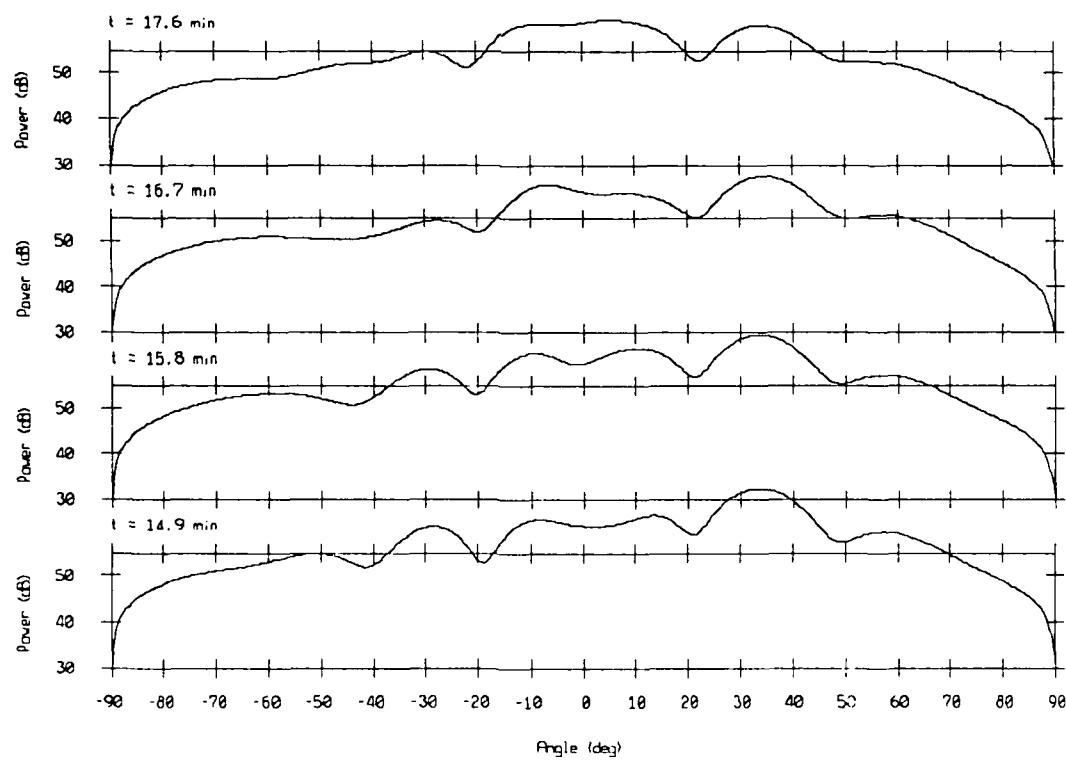




MICROCOPY RESOLUTION TEST CHART  
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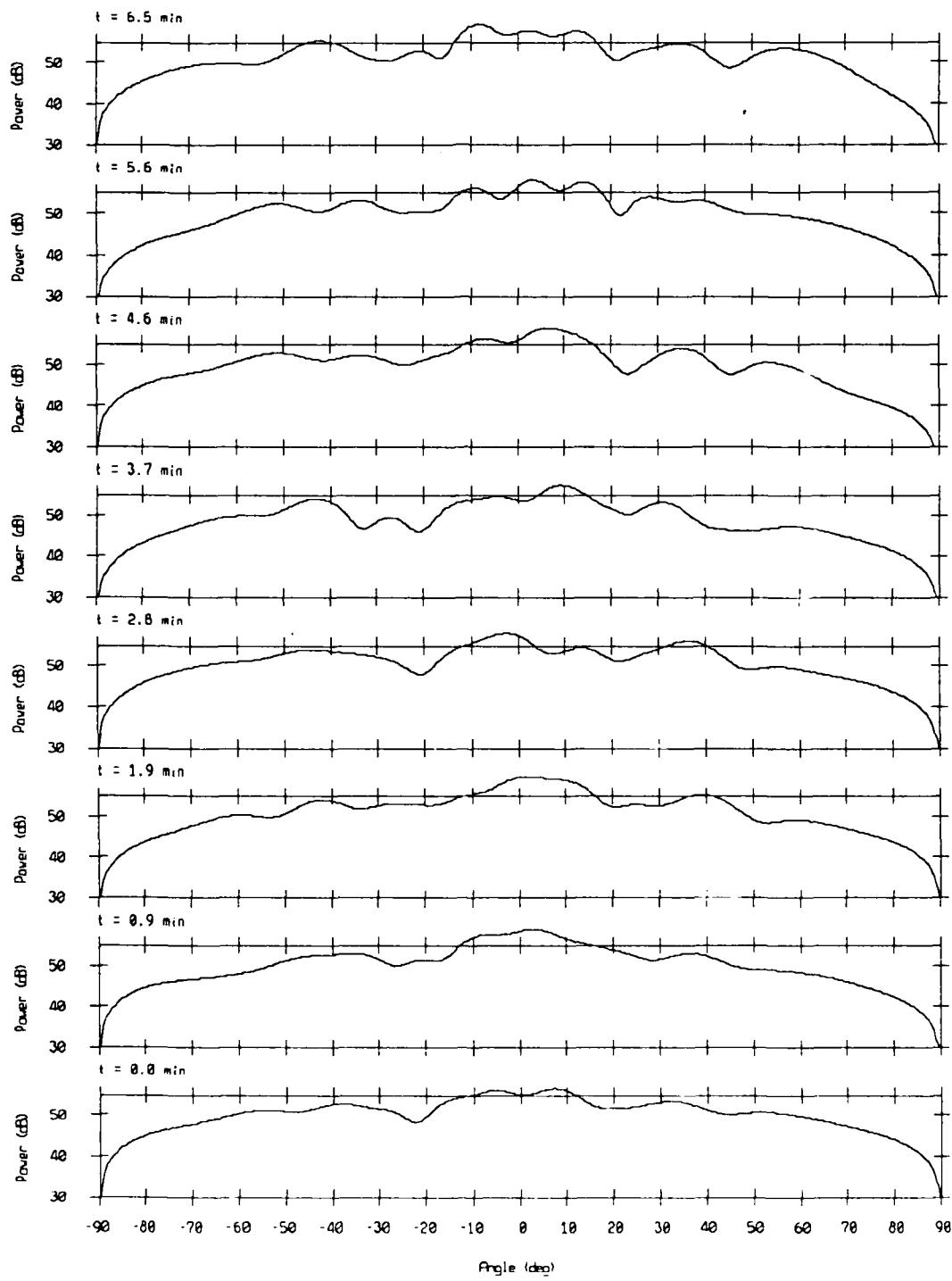
Array Response - 86060 Bin #4619

f = 75 Hz, rect window



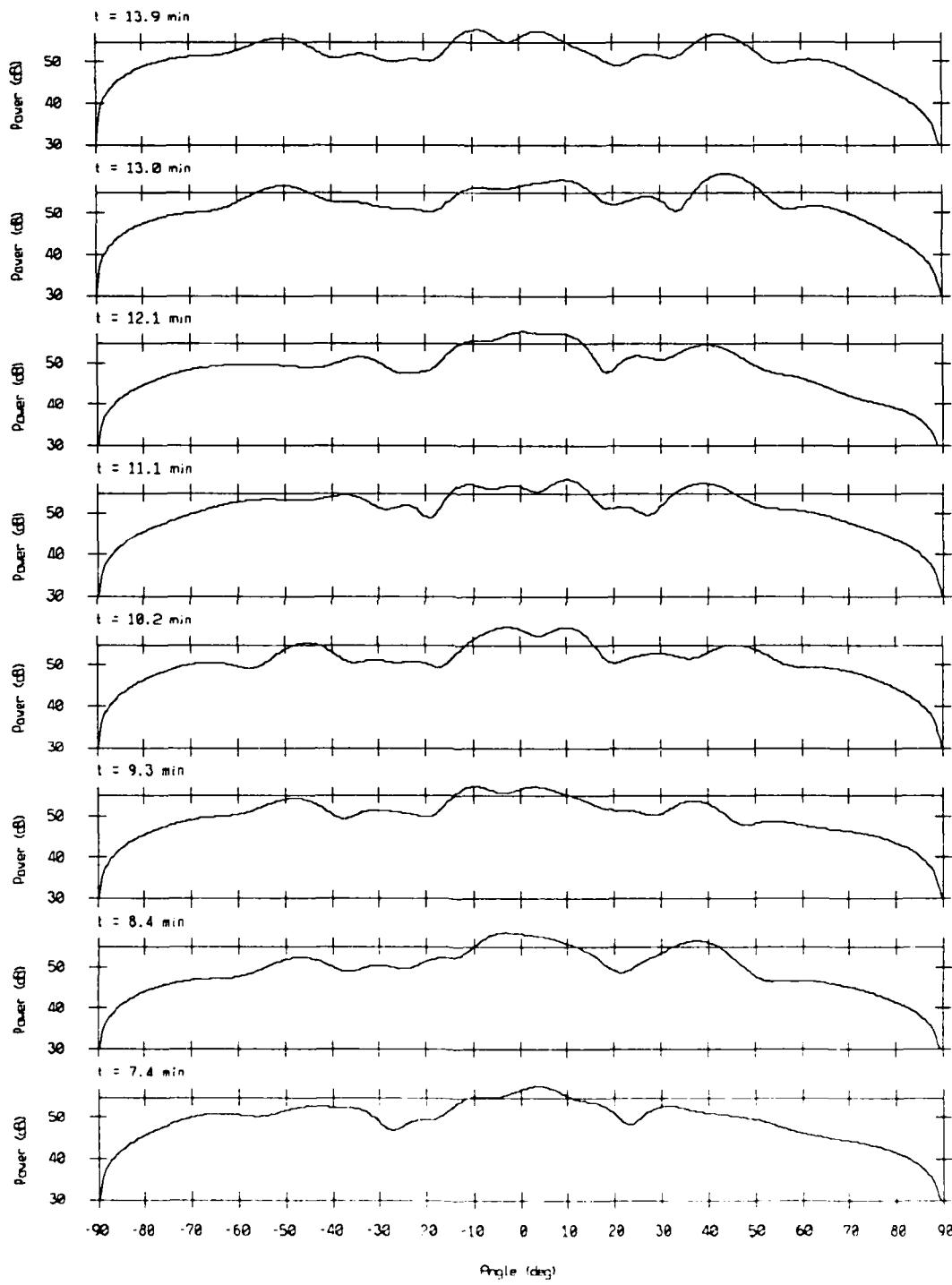
Array Response - 86060 Bin #4793

$f = 100$  Hz, rect window



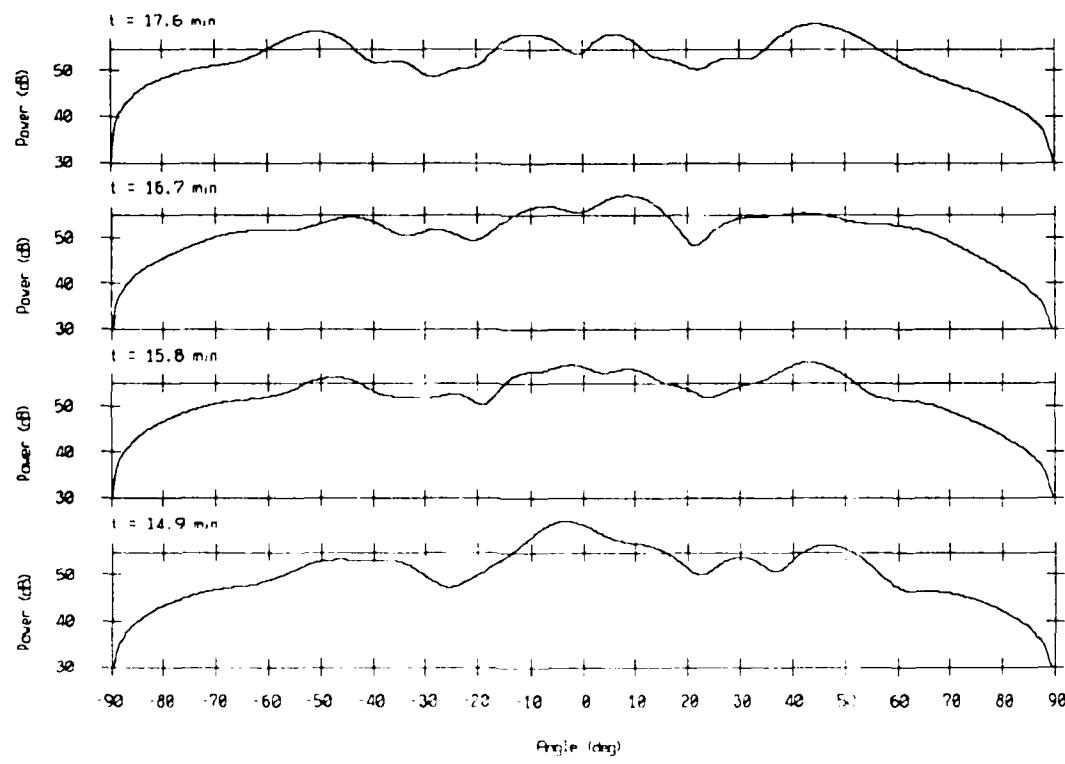
Array Response - 86060 Bin #4793

$f = 100$  Hz, rect window



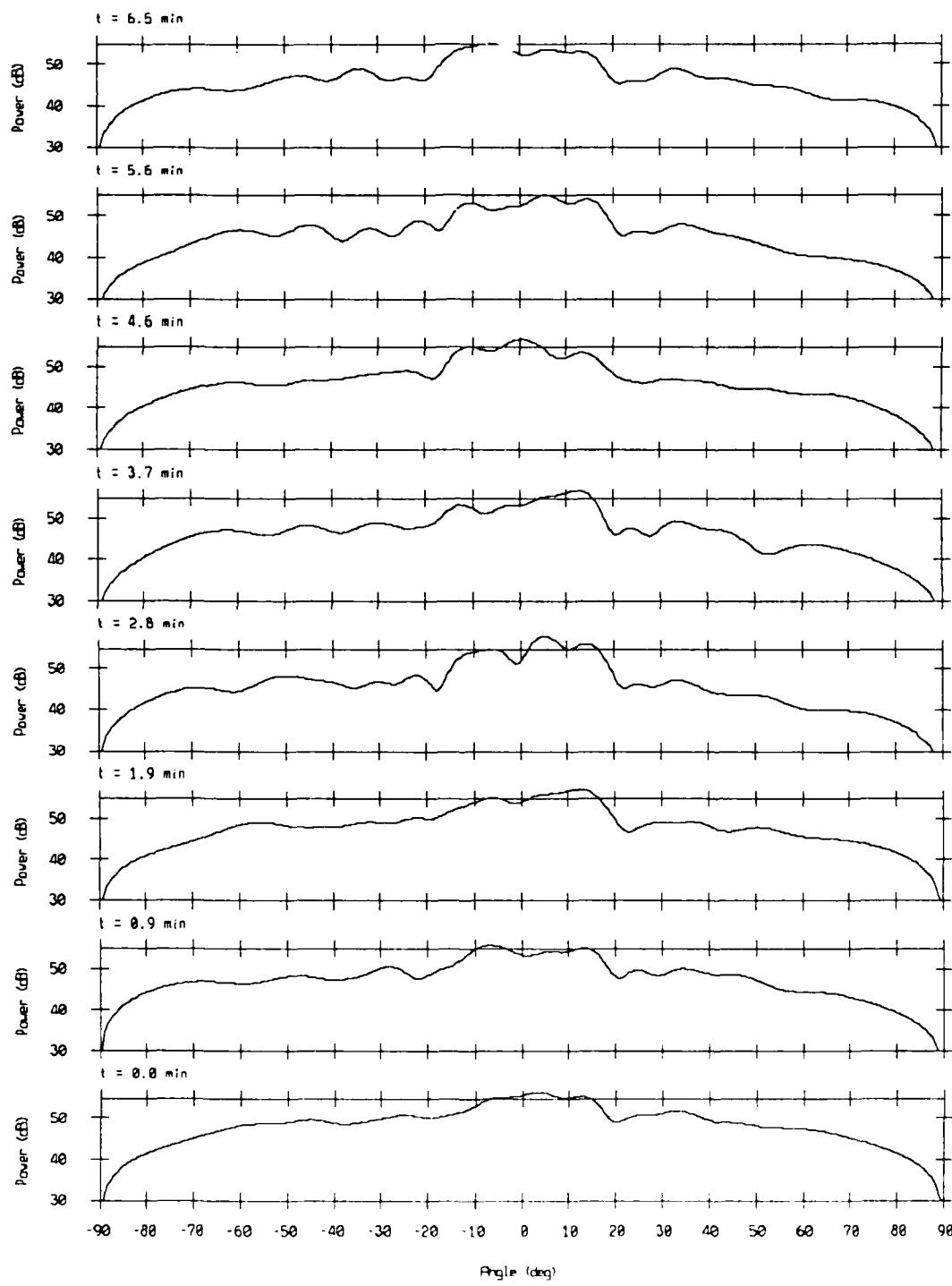
Array Response - 86060 Bin #4793

f = 100 Hz, rect window



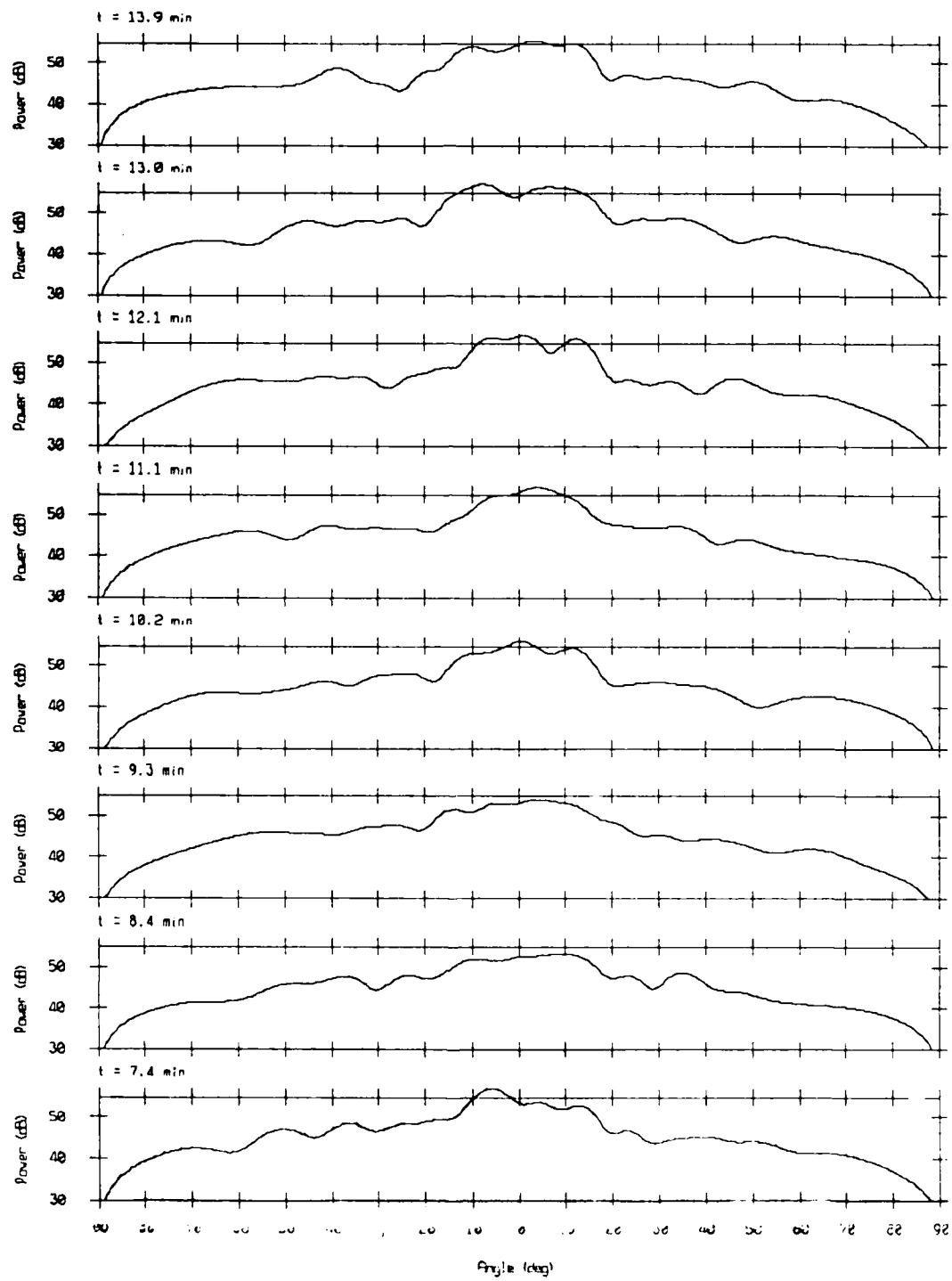
Array Response - 86060 Bin #4967

$f = 125$  Hz, rect window



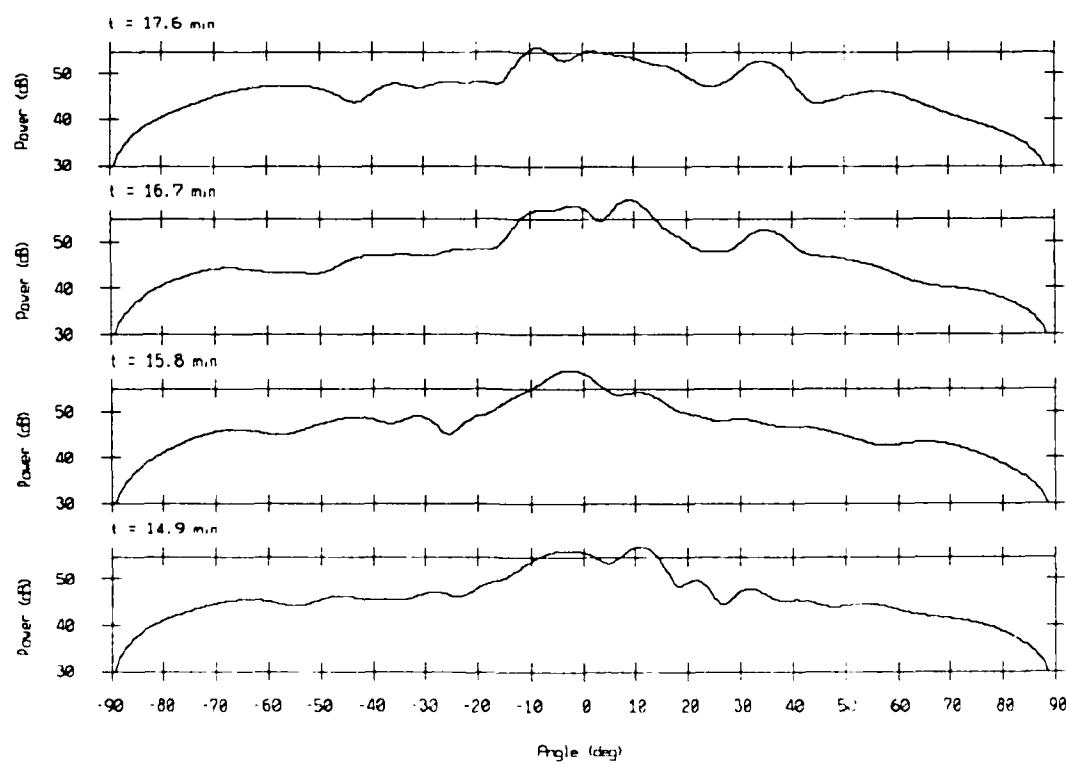
Array Response - 86060 Bin #4967

$f = 125$  Hz, rect window



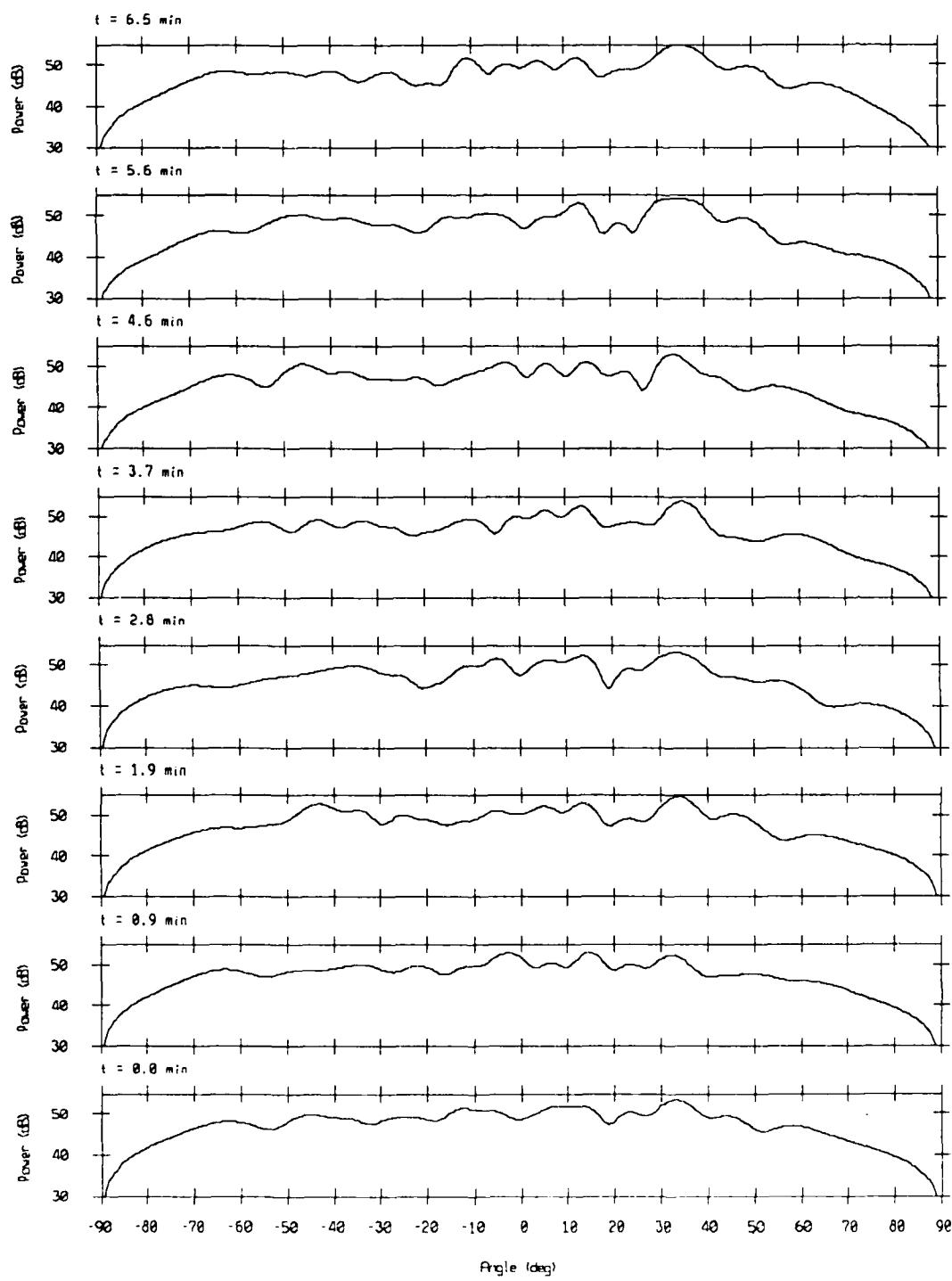
Array Response - 86060 Bin #4967

f = 125 Hz, rect window



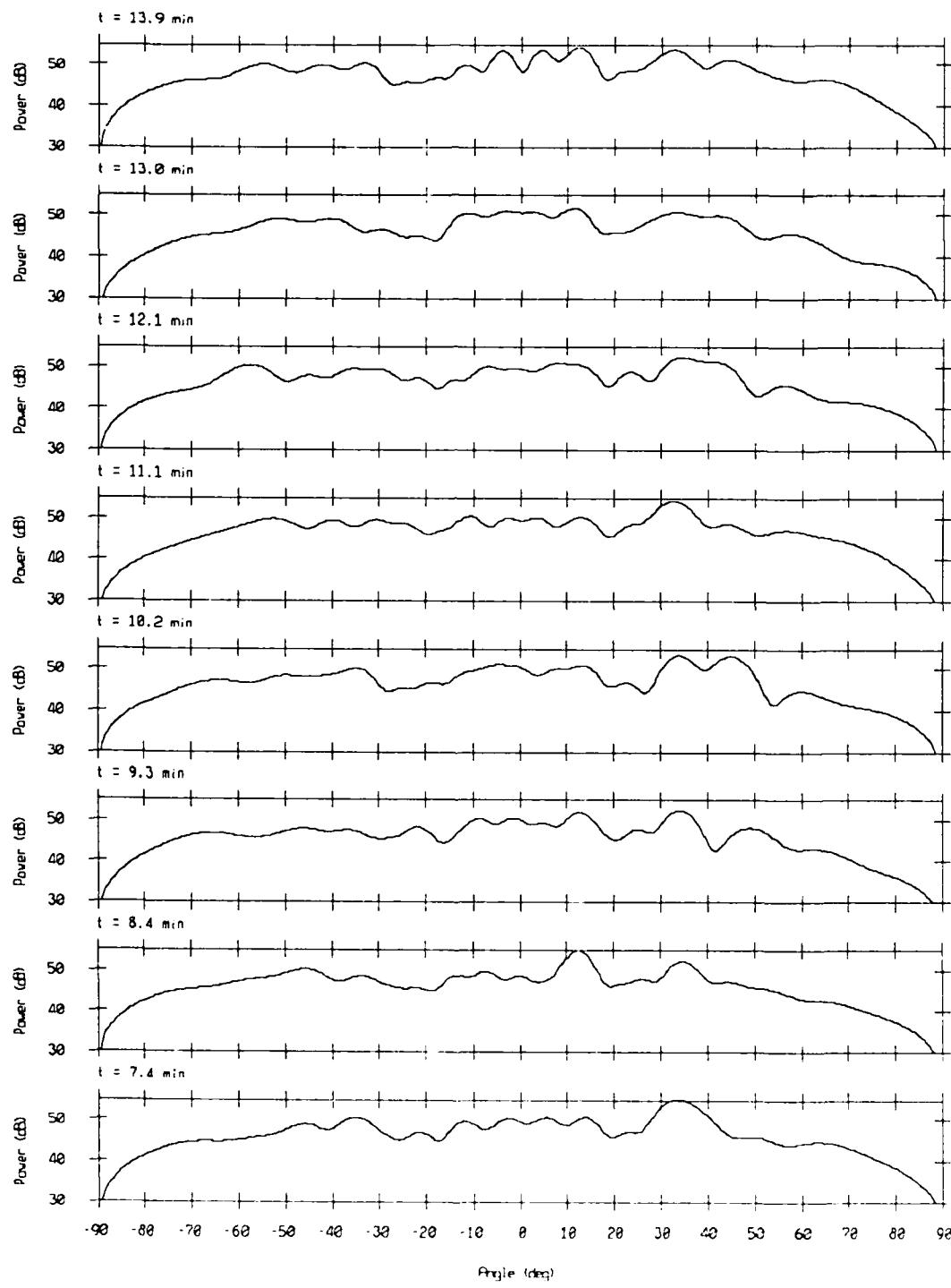
Array Response - 86060 Bin #5141

$f = 150$  Hz, rect window



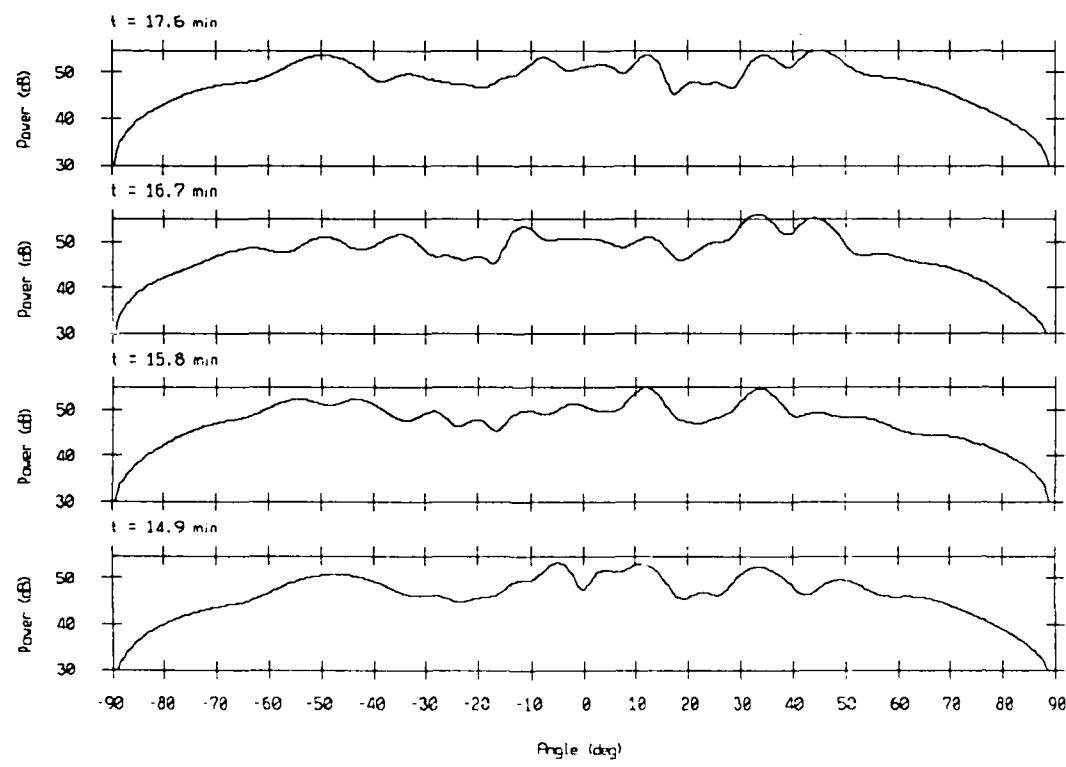
Array Response - 85060 Bin #5141

$f = 150$  Hz, rect window



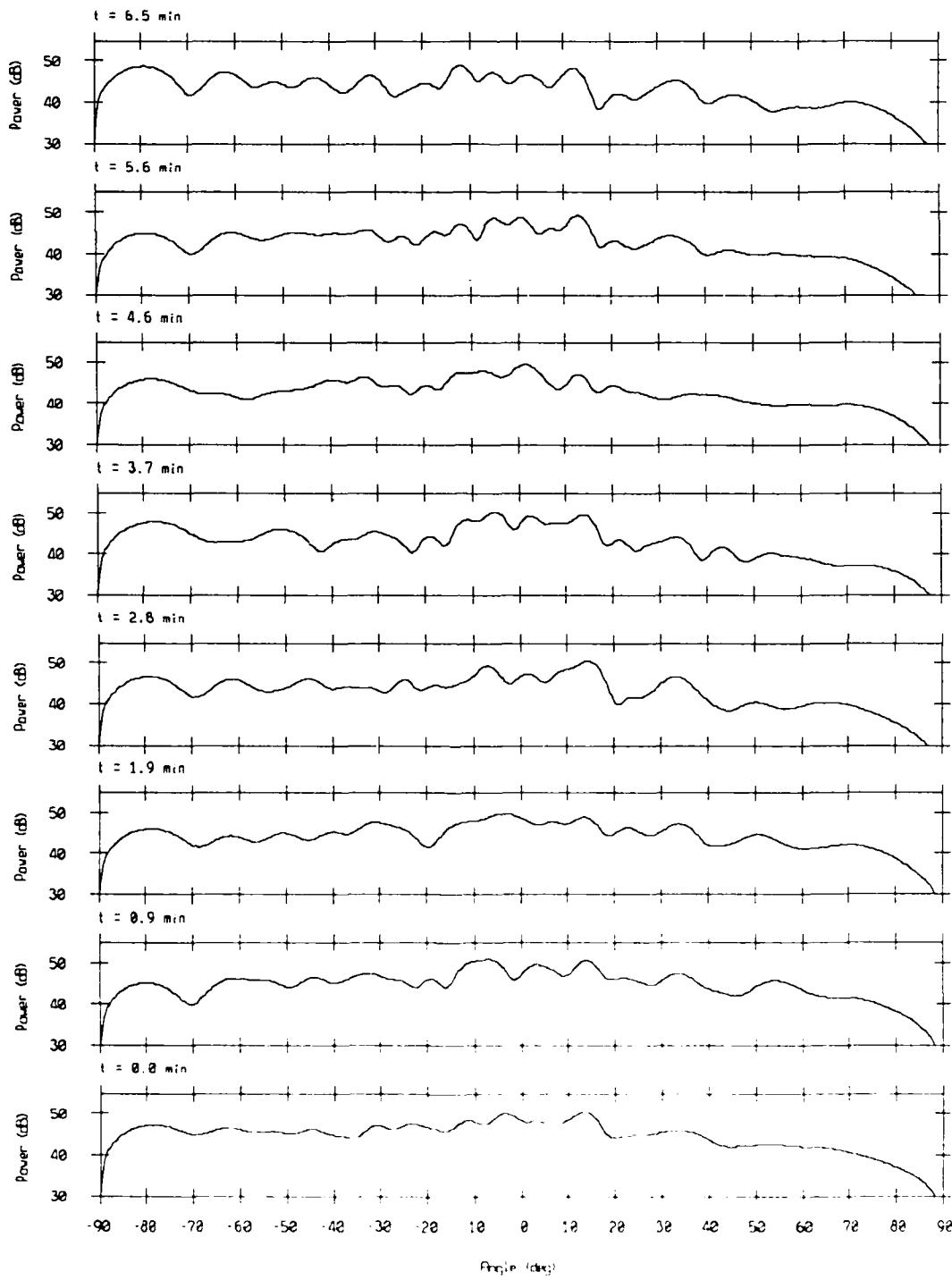
Array Response - 86060 Bin #5141

f = 150 Hz, rect window



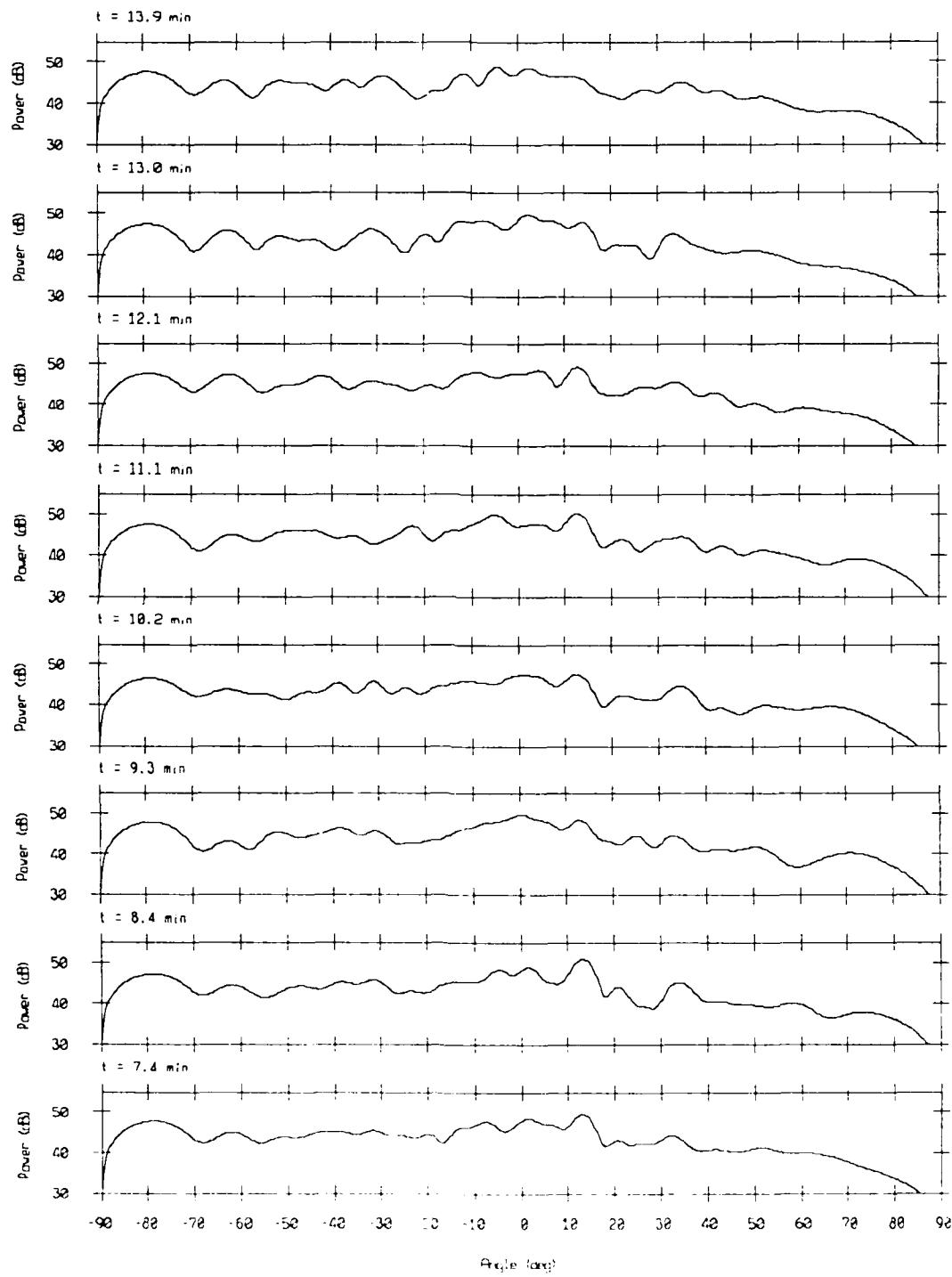
Array Response - 86060 Bin #5316

$f = 175$  Hz, rect window



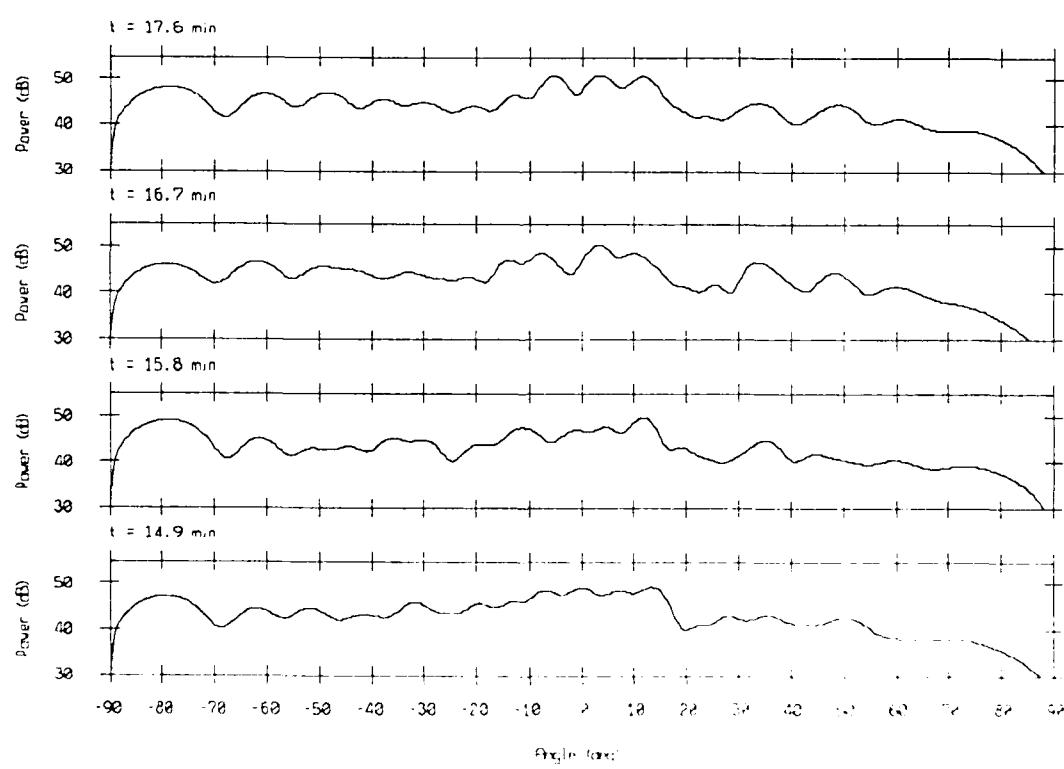
Array Response - 86060 Bin #5316

$f = 175$  Hz, rect window



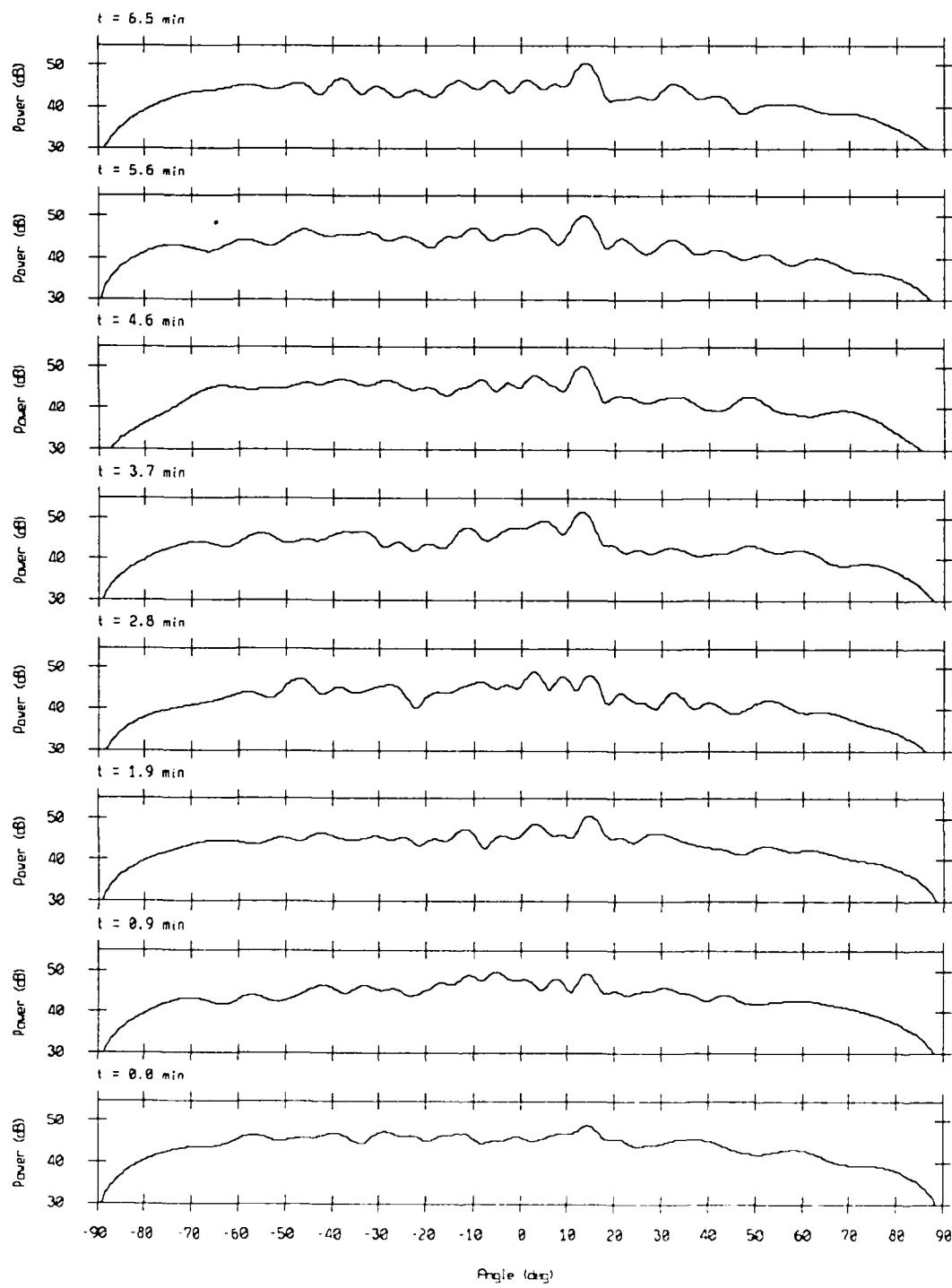
Array Response - 86060 Bin #5316

f = 175 Hz, rect window



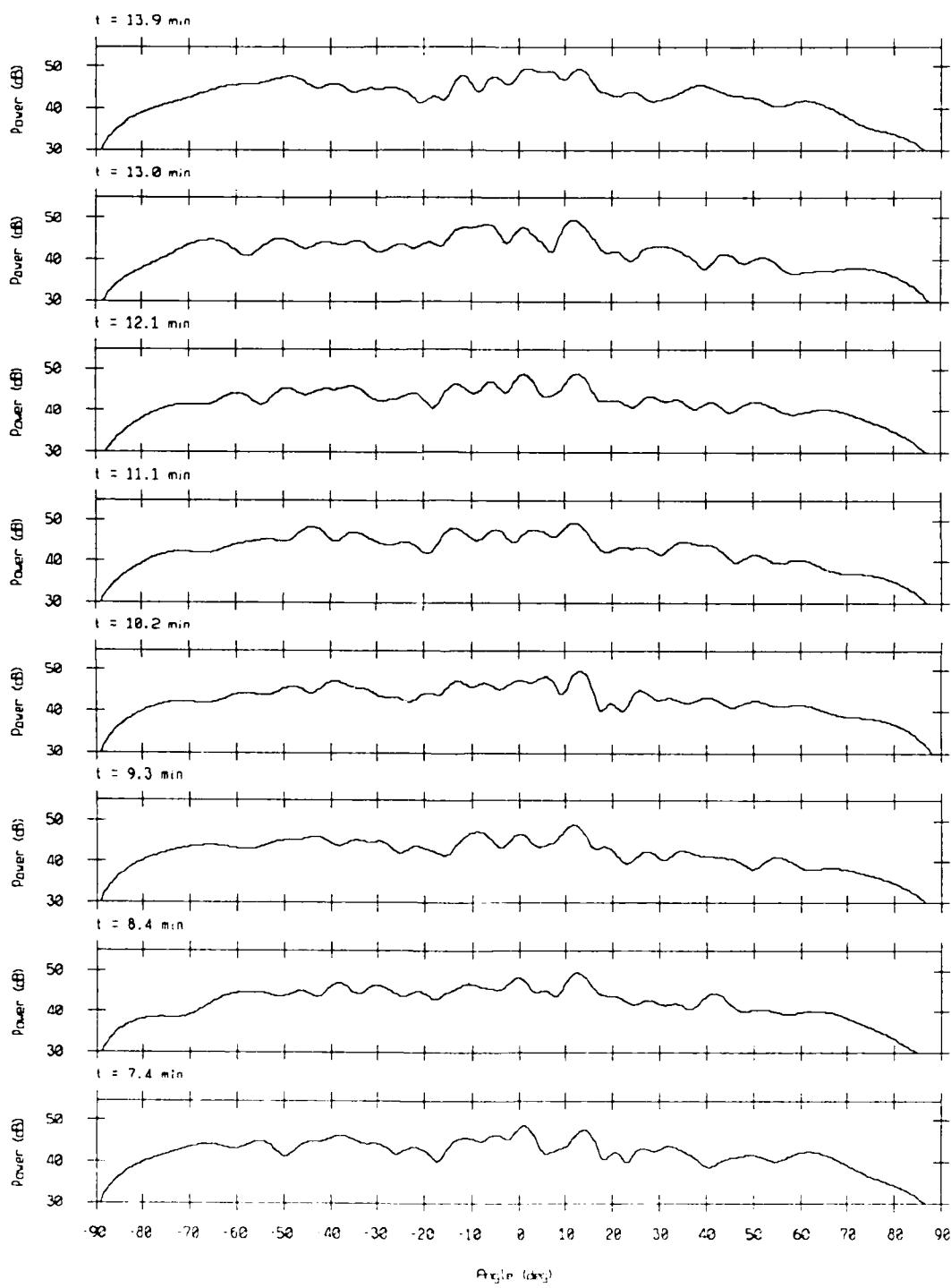
Array Response - 86060 Bin #5490

$f = 200$  Hz, rect window



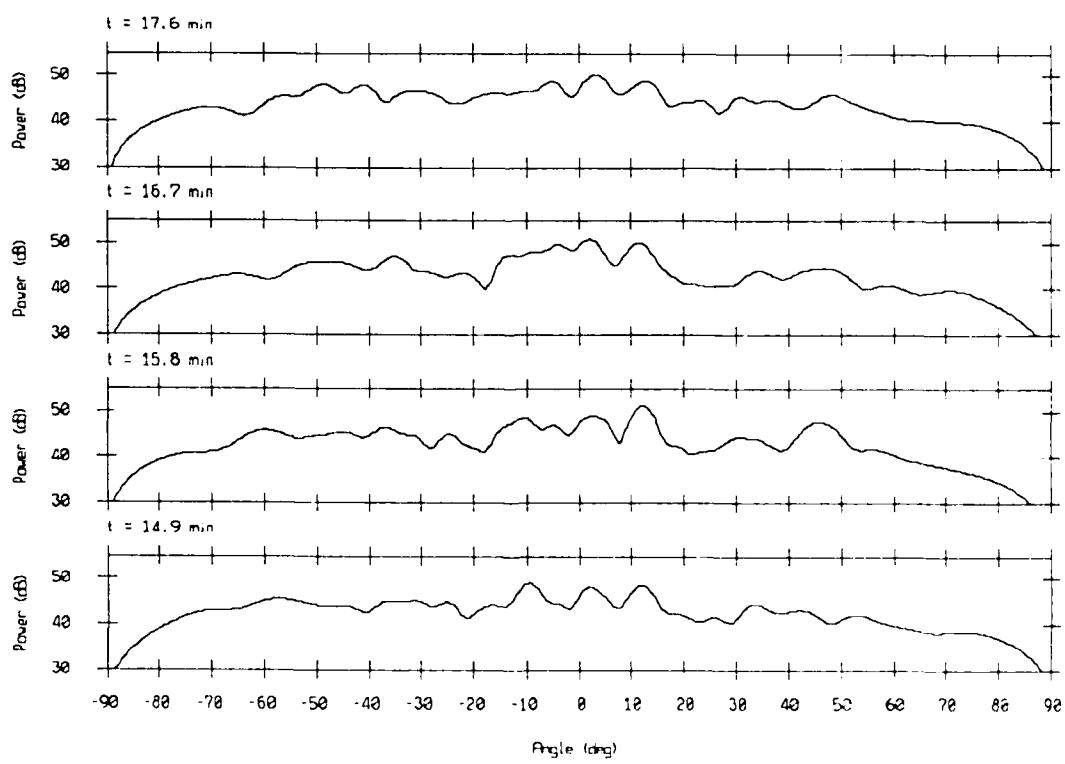
Array Response - 86060 Bin #5490

f = 200 Hz, rect window



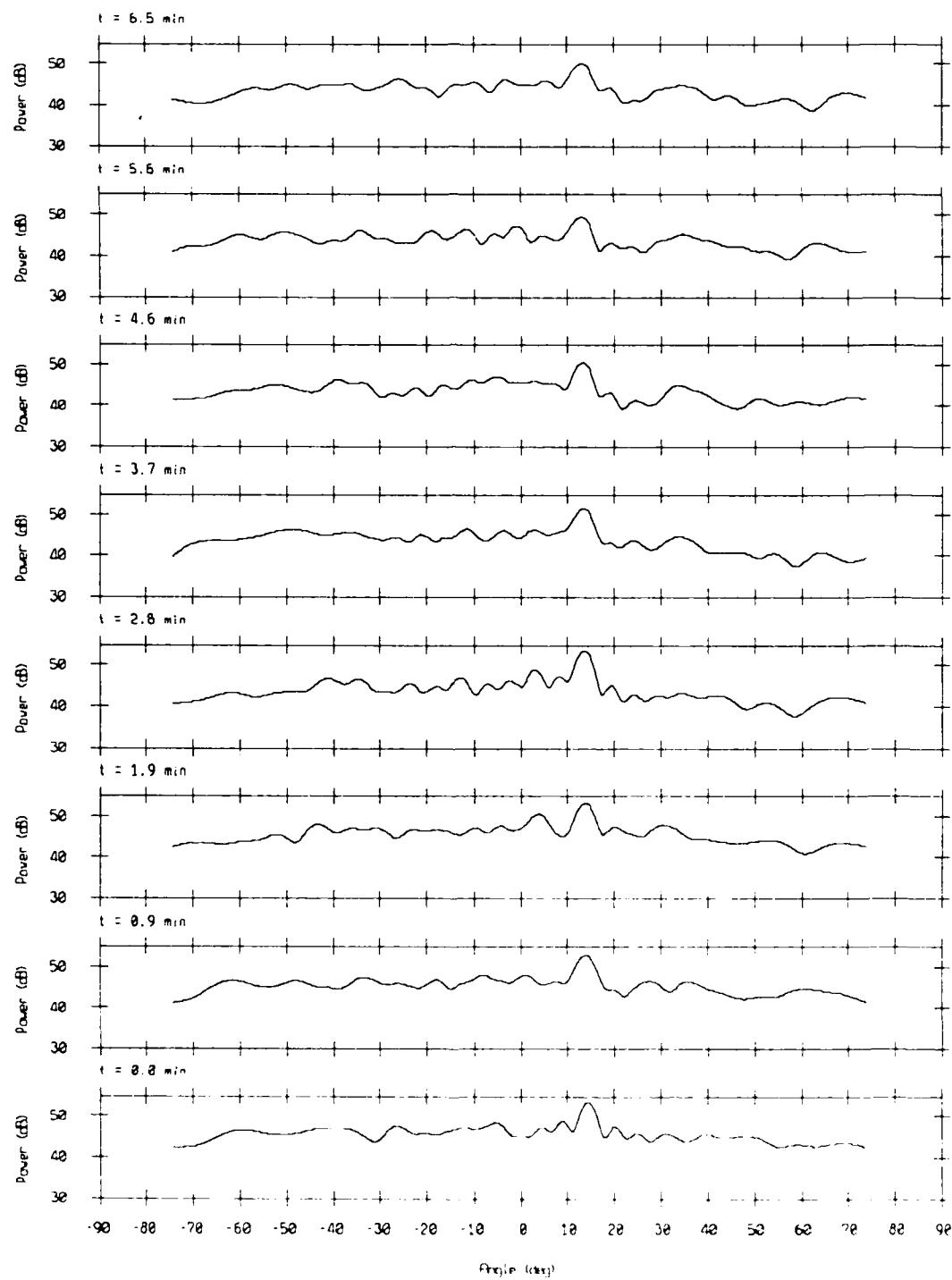
Array Response - 86060 Bin #5490

f = 200 Hz, rect window



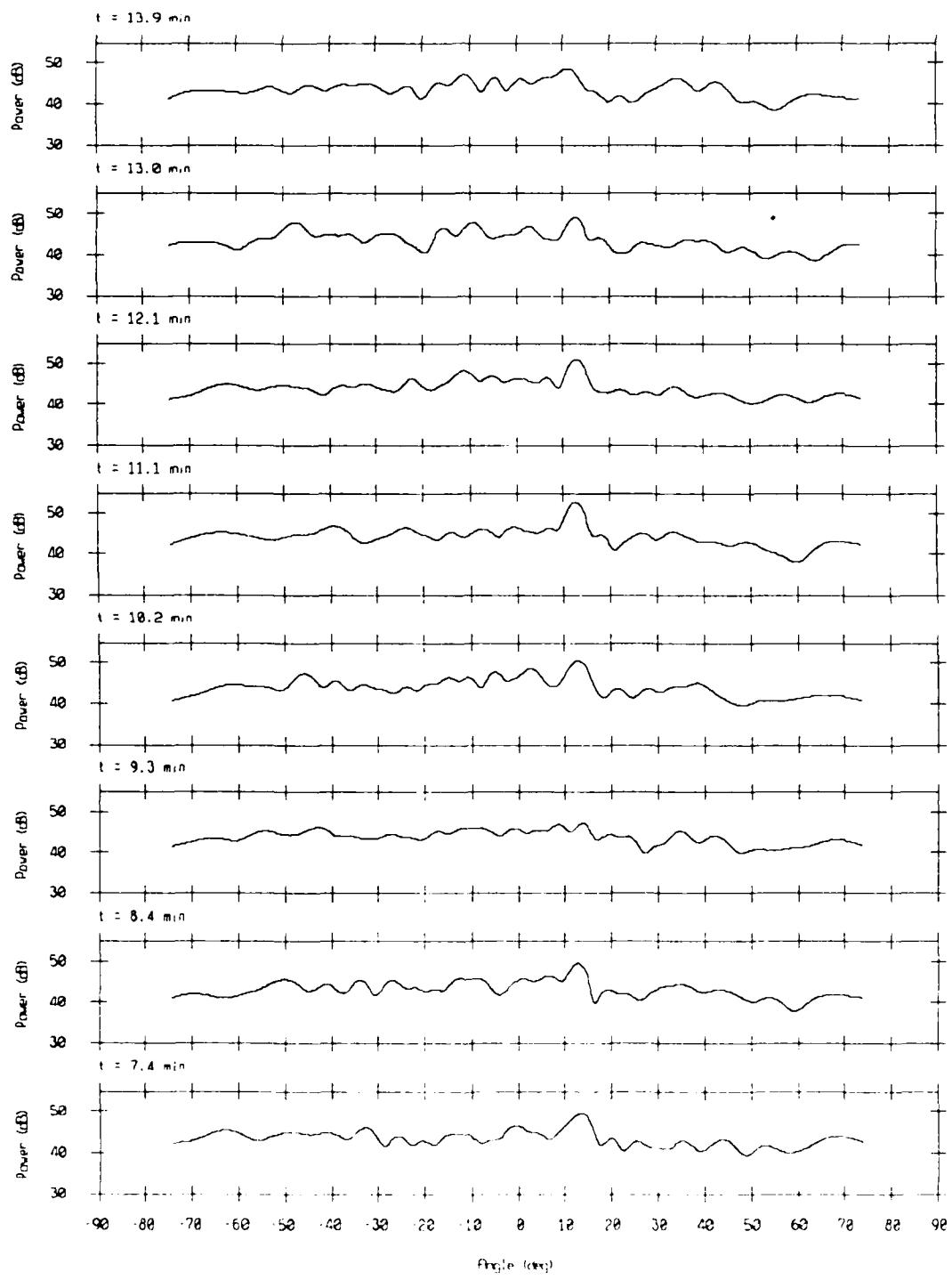
Array Response - 86060 Bin #5664

f = 225 Hz, rect window



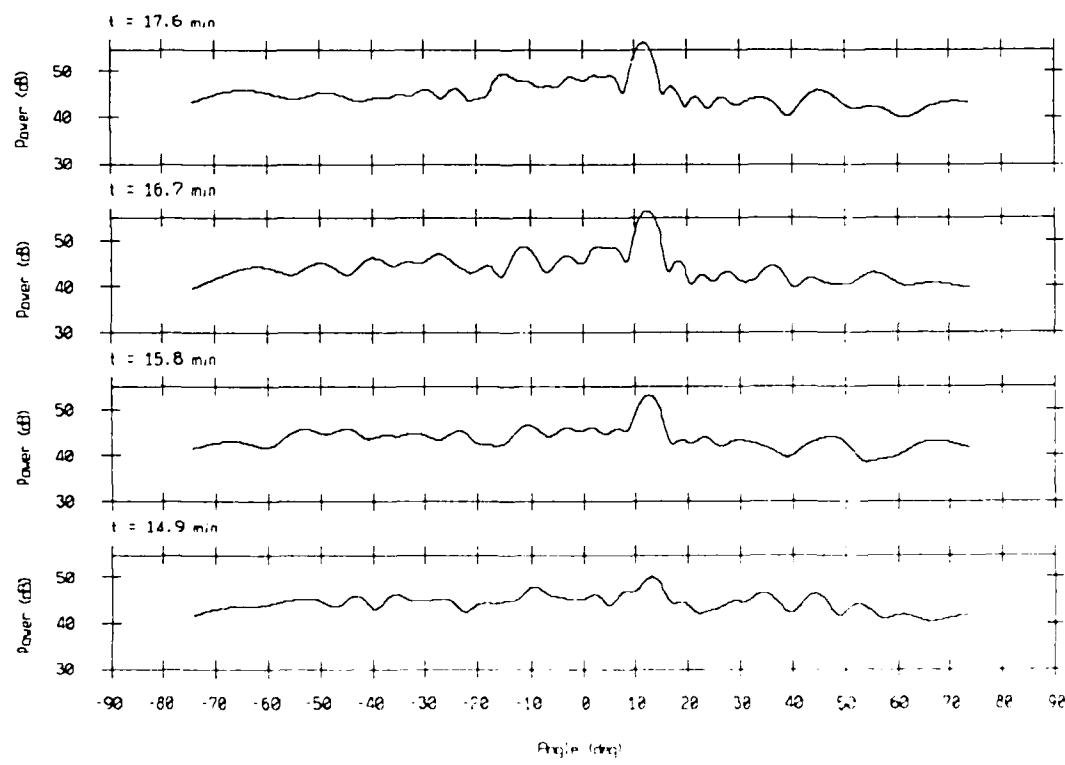
Array Response - 86060 Bin #5664

$f = 225$  Hz, rect window



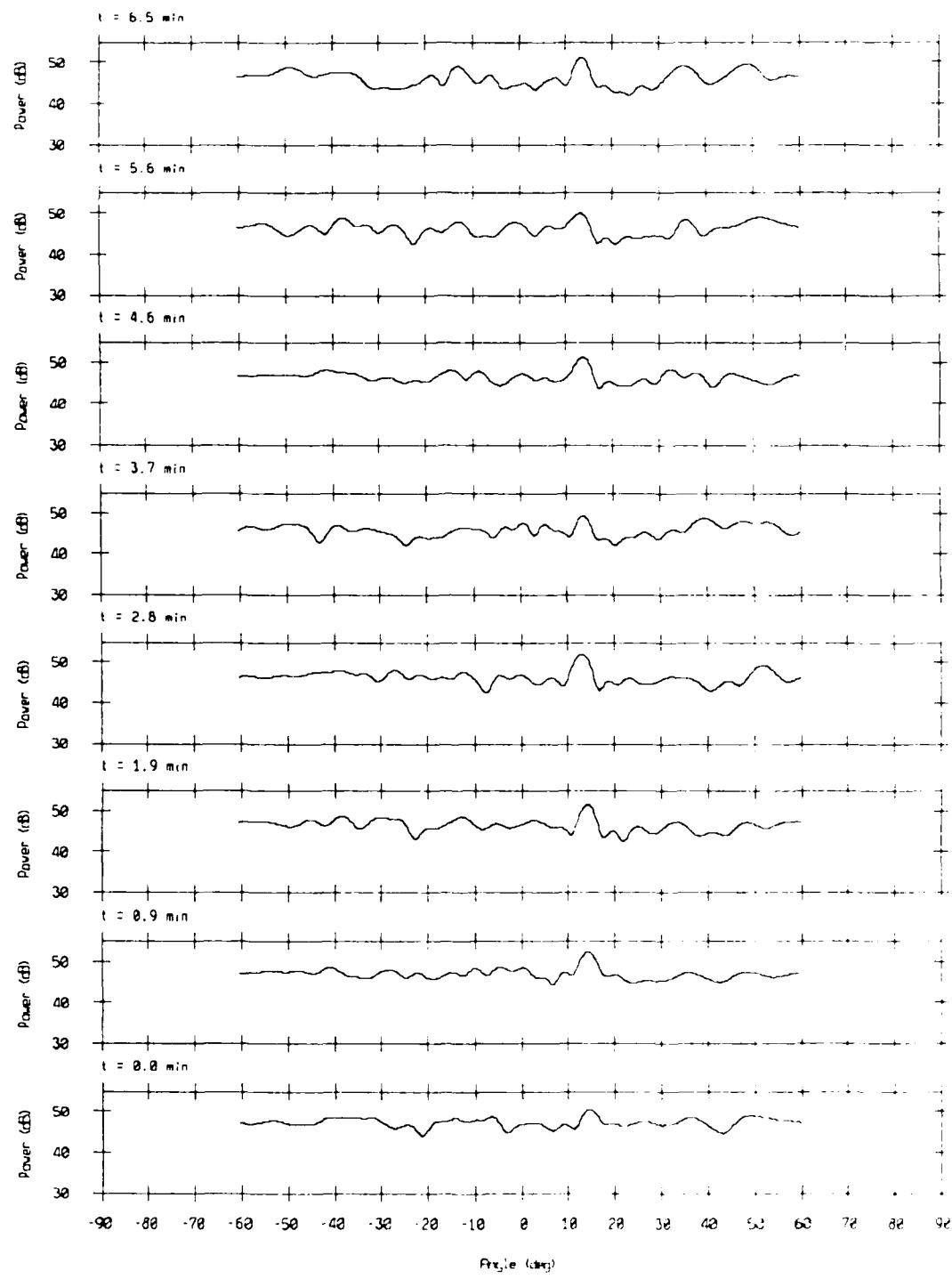
Array Response - 86060 Bin #5664

f = 225 Hz, rect window



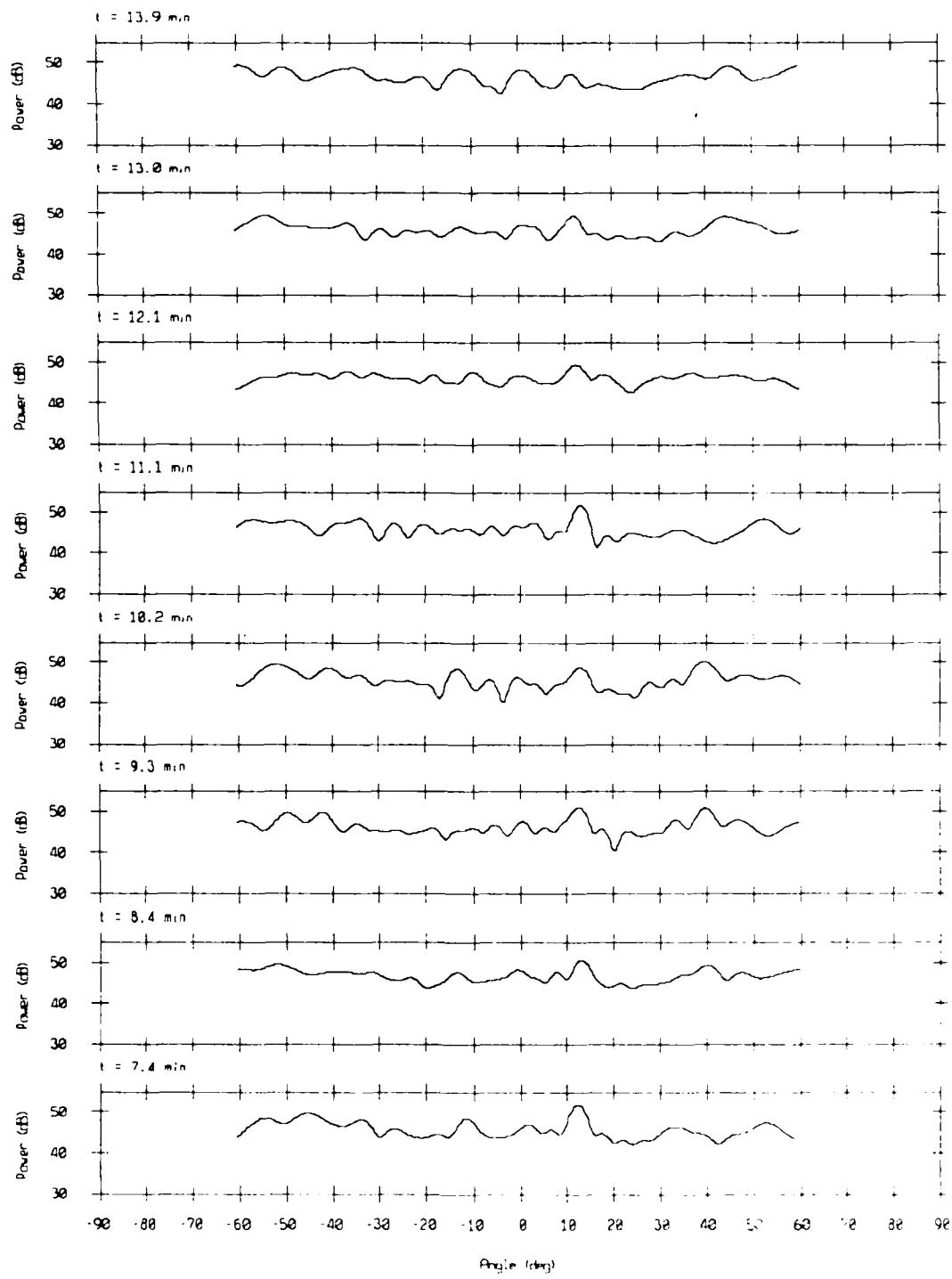
Array Response - 86060 Bin #5832

$f = 250$  Hz, rect window



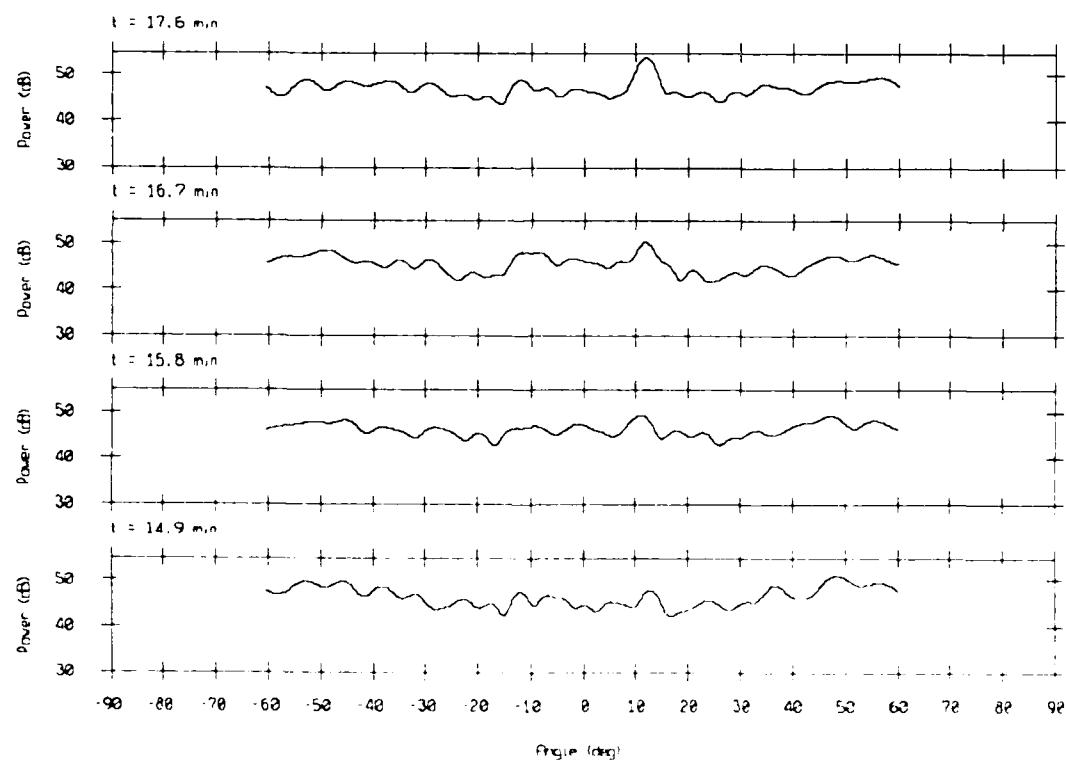
Array Response - 86060 Bin #5832

f = 250 Hz, rect window



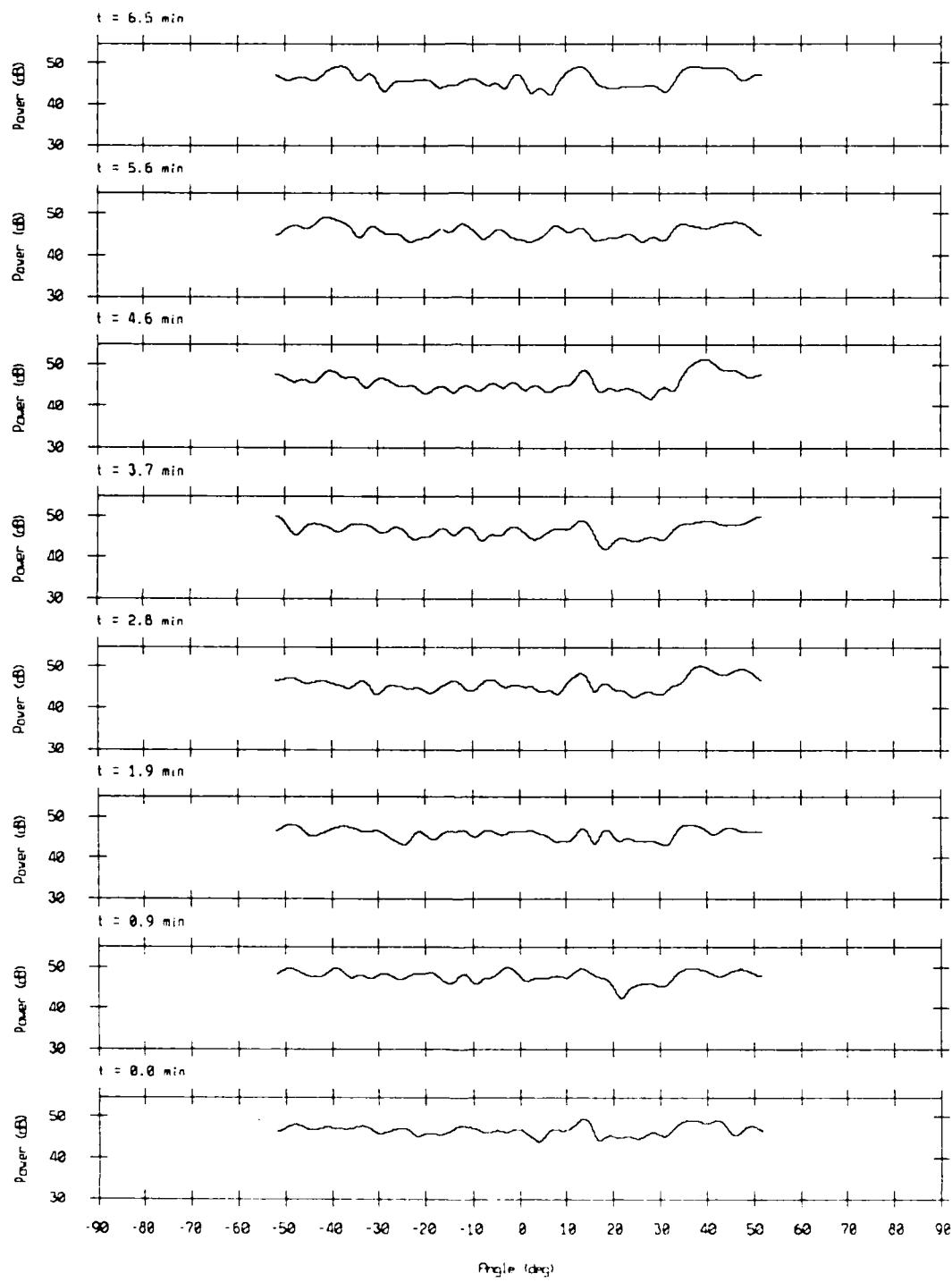
Array Response - 86060 Bin #5832

f = 250 Hz, rect window



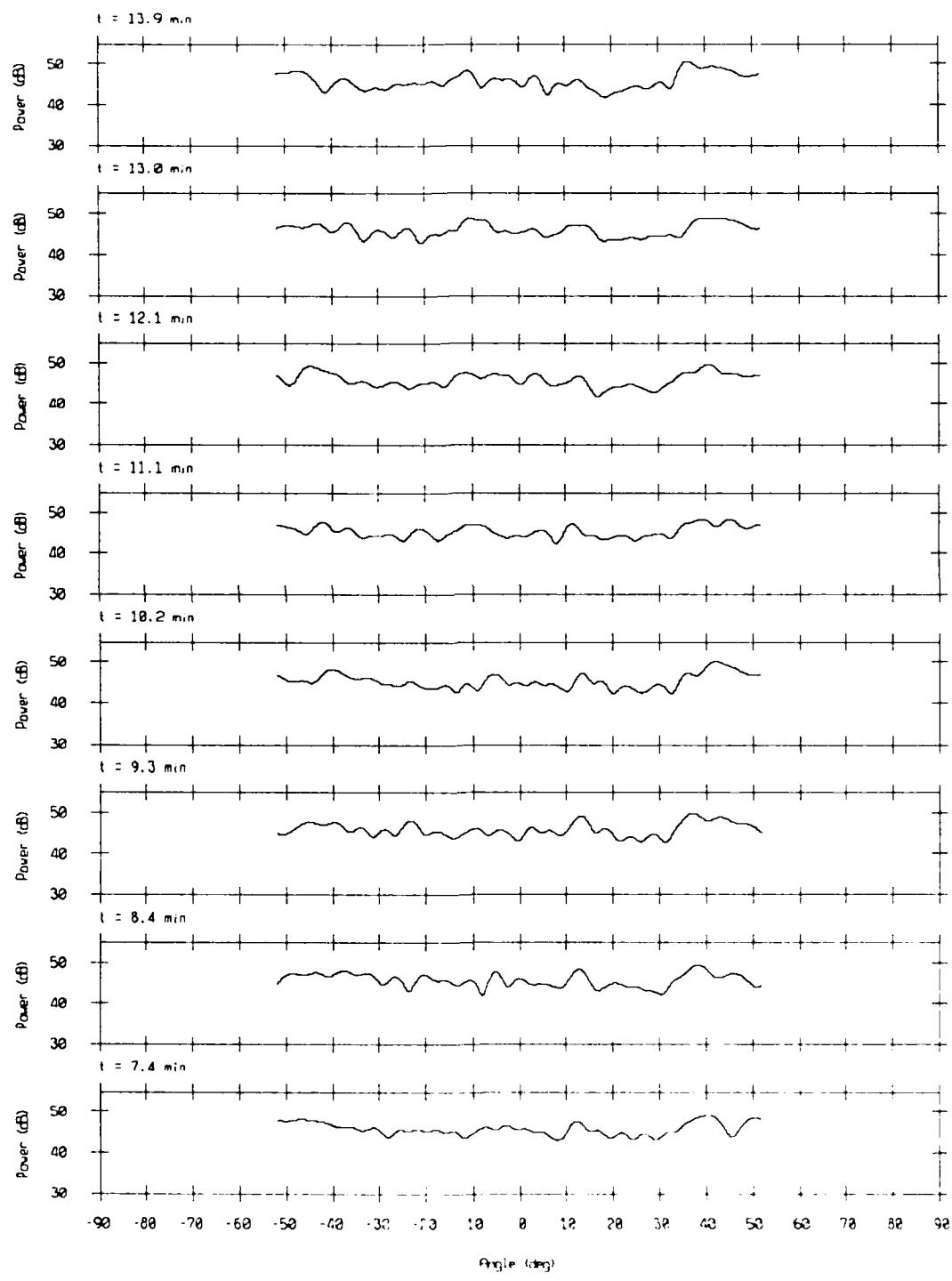
Array Response - 86060 Bin #6012

$f = 275$  Hz, rect window



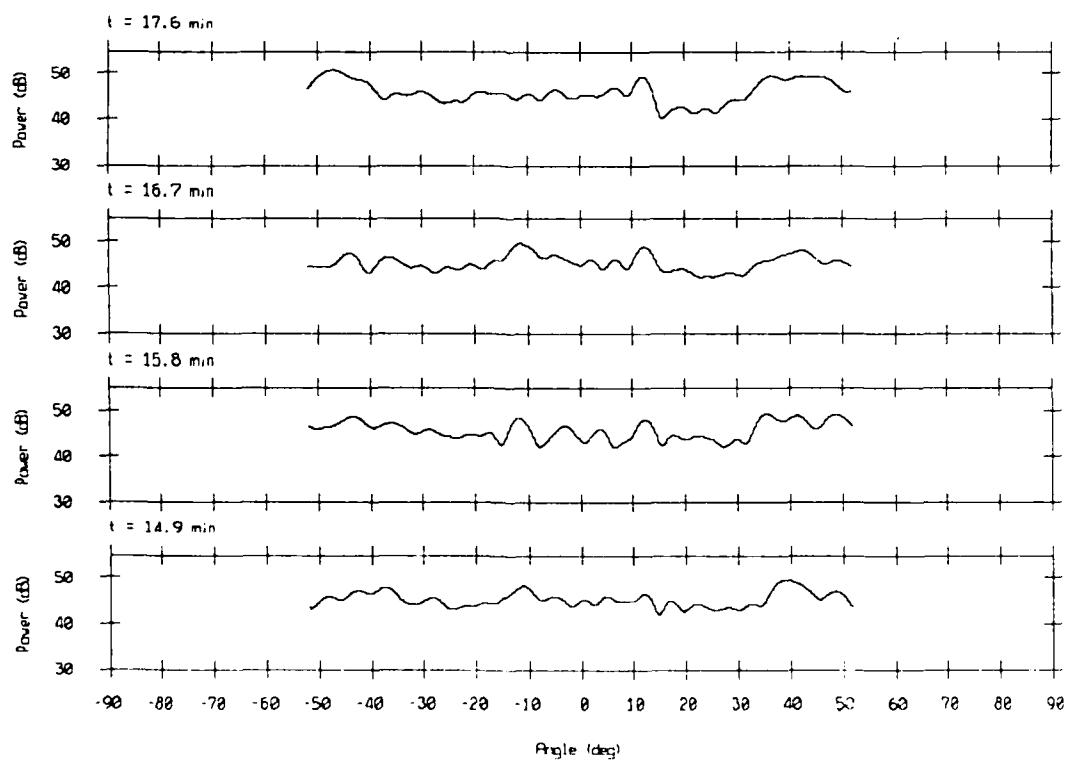
Array Response - 86060 Bin #6012

$f = 275$  Hz, rect window



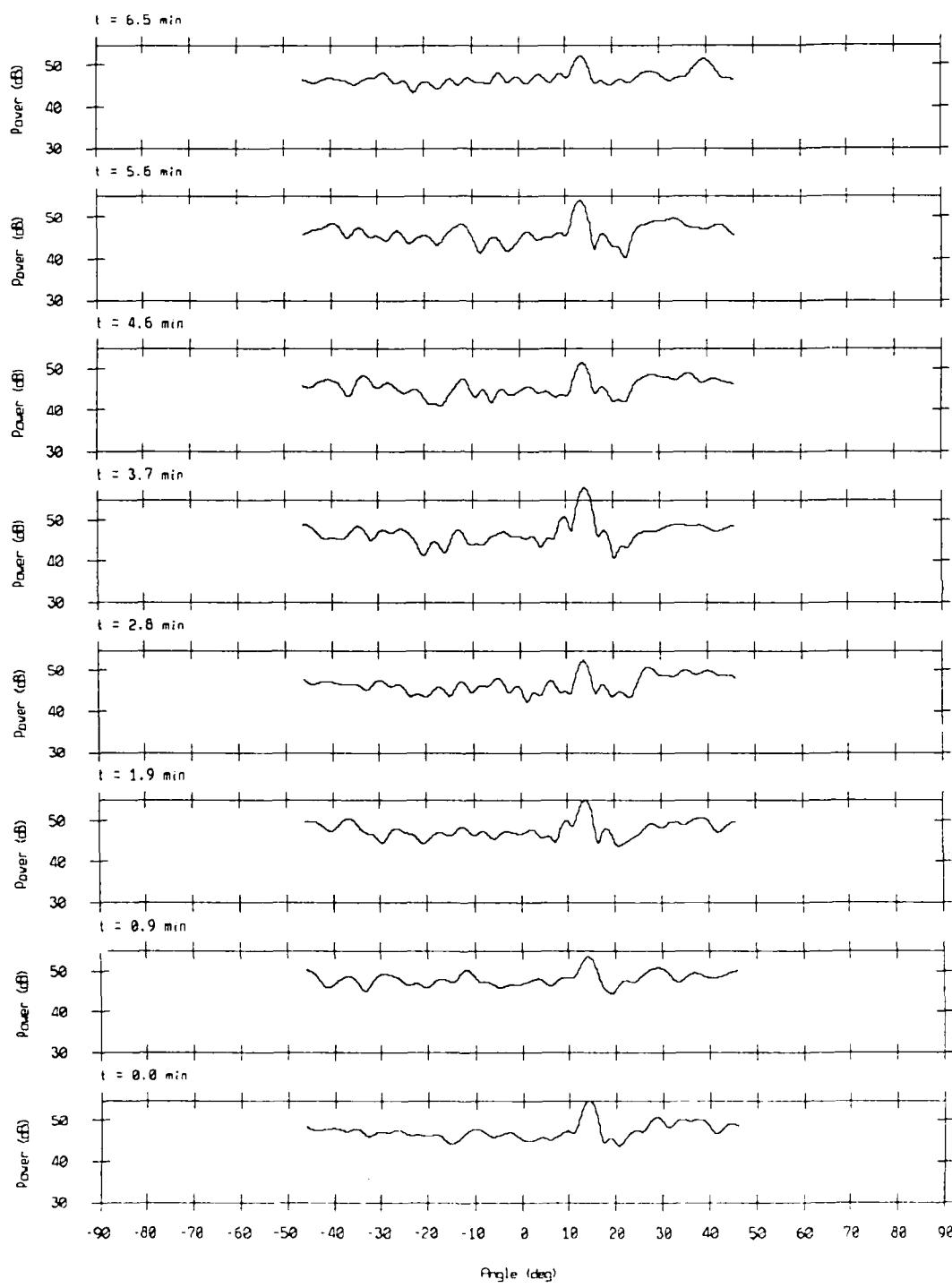
Array Response - 86060 Bin #6012

$f = 275$  Hz, rect window



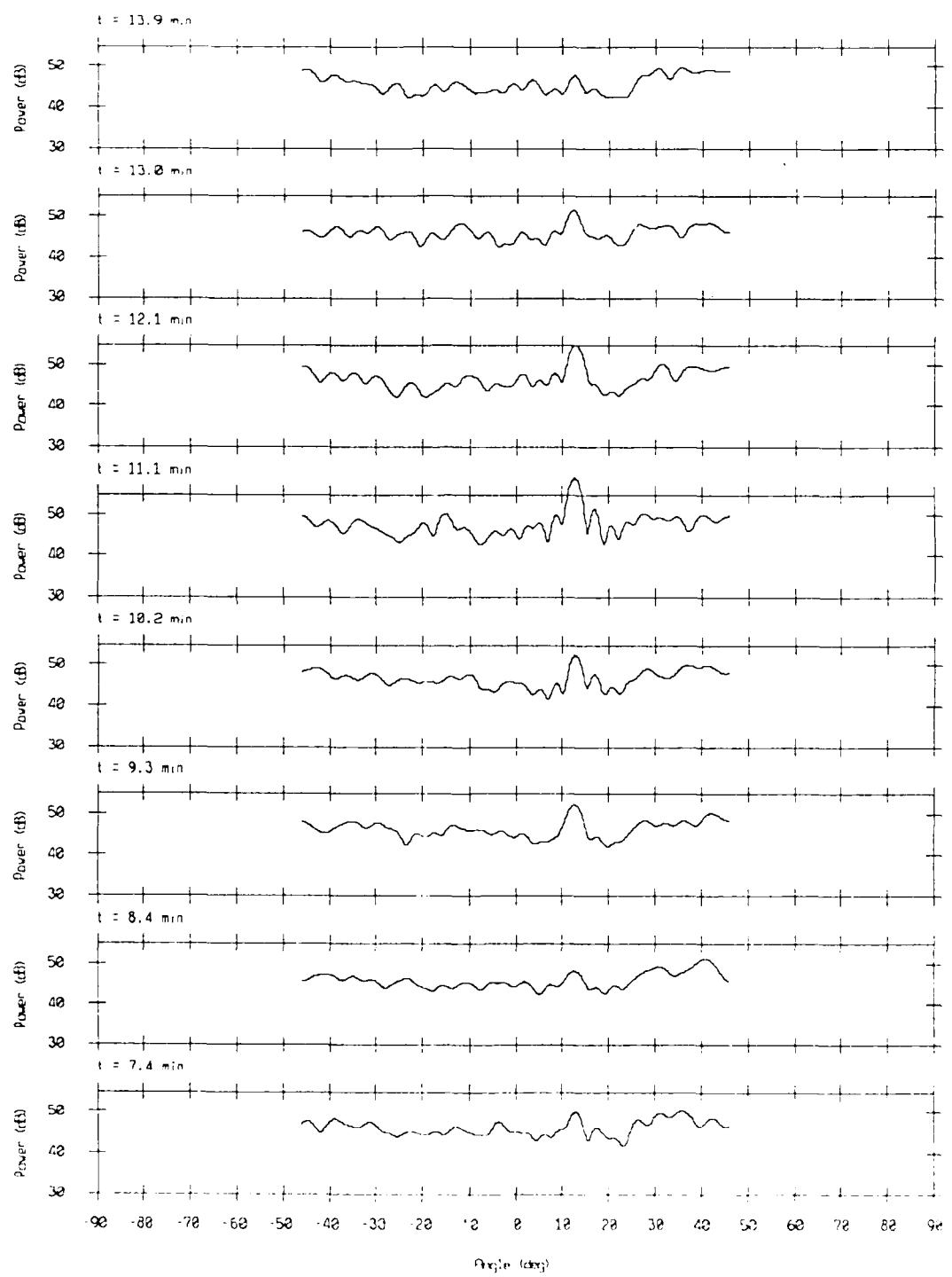
Array Response - 86060 Bin #6186

$f = 300$  Hz, rect window



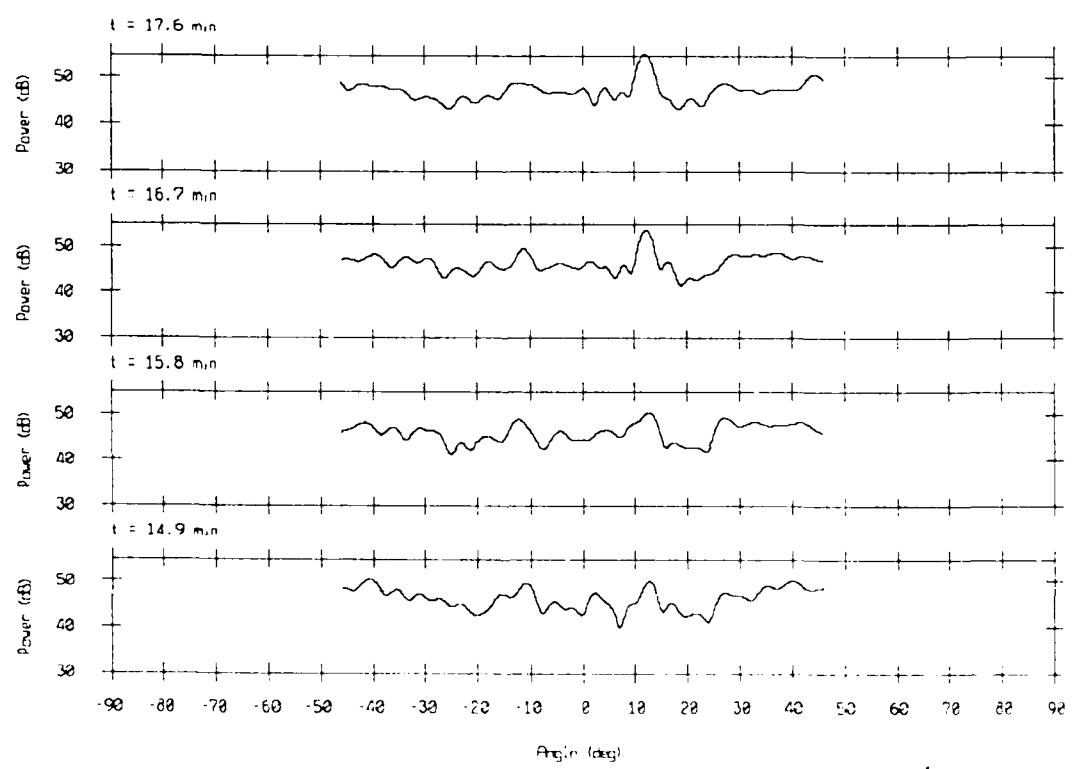
Array Response - 86060 Bin #6186

$f = 320$  Hz, rect window



Array Response - E6060 Bin #6186

f = 300 Hz, rect window



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